THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XI. Part 8. 11th August, 1913.

RECENT DEVELOPMENTS IN WINE-MAKING METHODS.*

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Wine-making is, without a doubt, one of the oldest of the manufacturing arts concerned in the conversion of raw agricultural produce into a highly-finished food substance. As old, perhaps, as the ceramic art which, in the dawn of civilization, found so large a field for its activity in supplying wine-containing vessels.

Notwithstanding this great antiquity, it has, curiously enough, been one of the slowest to avail itself of the discoveries of modern science, the practical application of which, during the latter part of the last century more particularly, has wrought so vast a revolution in every branch of human activity as to make even passing mention of the fact here superfluous.

It is true that in this respect, wine-making shares in a defect common to most industries directly connected with the soil; for scientific methods have ever been slower in commending themselves to agriculturists or to those interested in the treatment of agricultural produce than to manufacturers, properly so called.

Even amongst agricultural industries, however, wine-making may truly be said to be the "Cinderella" of the family in the way of shyness to adopt improvements of any kind. The sister brewing industry, for example, so similar in many respects, has long since adopted, with the happiest possible results, methods similar to those which have only recently found their way into the most progressive œnological centres of Europe.

Dairying, which includes butter and cheese making, another fermentation industry, has long since adopted the modern methods which have led to its recent remarkable expansion.

* Paper read at the Melbourne meeting (1913) of the Australasian Association for the Advancement of Science.

In wine-making, though it has come tardily, the great change has nevertheless come at last, and it has come to stay; it is the object of the present note to briefly outline the more recent wine-making developments and to show what bearing their general adoption is likely to have on wine production in Australia. A brief glance at the state of the art of wine-making in Europe towards the close of the last century may here be permitted.

For several centuries at least, wines of the very highest quality have been produced. Quality in wine has a totally different signification from what it has in the case of other food substances, such as flour, sugar, butter, and even beer. In these, quality is largely a matter of freedom from defects, and once a certain standard is reached, little more is possible. For a wine to attain a really high standard of excellence, freedom from defects is, of course, an absolute necessity, but far more is required; a *grand vin* may truly be described as a work of art, and as such it can only be judged by certain more or less conventional standards. Thus we may find two wines of similar type, both free from defects, and yet one may be worth several times as much as another. *Grand vins* have been produced, in occasional vintages it is true, for hundreds of years in several favoured European districts. It is indeed safe to say that as good wines have been produced in the past as will ever be produced again, and this entirely by means of empirical methods carried out by cellarmen quite ignorant of science.

A parallel is to be found in pictorial art. Notwithstanding the advances of technical knowledge, nothing finer has been produced than the masterpieces of Raphael, painted nearly 400 years ago. Likewise with wine; what could be better than a Chateau Margaux '64, a Chateau Lafite '69, or a Chateau Latour '70? They are the perfection of their type, and nothing could improve them in any way.

The very perfection of such wines is largely responsible for the tardy adoption of scientific methods by European wine-makers. Owners of the vineyards which produced *grand vins*, naturally jealous of their reputation, feared any change. Their prejudice spread to their customers and to the wine-makers of less favoured regions, where improvement was often urgently required and where the adoption of scientific methods has recently transformed the wines produced.

Owing largely to this attitude, scientific enlightenment has had to fight its way inch by inch against conservative prejudice.

It must also be remembered that wine-making is vastly different from brewing or distilling. Nature serves up the juice of the grape, complete in itself and ready for fermentation; she even goes so far as to place the yeast required for the transformation, on the outside of the berry. All that is necessary is to crush the grape, the wine practically makes itself. Given perfect grapes in a district where suitable physical conditions prevail during the fermentation season, a good wine is almost sure to result, provided the wine-maker attends to cleanliness and follows the process which centuries of practice have sanctioned in his district. It is worthy of note that even in localities producing similar types of wines, and of equal quality, the procedure concerning several important points may vary very considerably.

Take Bordeaux and Burgundy, for example; in the former the grapes are entirely separated from the stalks and the wine is allowed to remain on the skins in closed vats for three or four weeks. In the latter, most of the stalks are mixed with the crushed grapes in the vat, where the fermentation only lasts about a week.

The above applies to those favoured regions where the composition of the grapes is perfect and where vintage weather conditions are suitable. In less favoured districts it has long since been found necessary to employ some artificial aid in the shape of a check to faulty fermentation. Thus do we find certain practices which have from time immemorial been carried out in certain districts, and which permitted the making of sound wine where this would have been otherwise impossible or very difficult. In choice districts, such as Bordeaux and Burgundy, the danger of faulty fermentation is small, owing to the relatively high acidity of the grapes; further security is afforded by the cool weather prevailing during vintage. In warmer regions difficulties have to be faced such as are unknown in the cooler districts, save in rare abnormal seasons, and, in order to combat them, additions of one sort or another have long been in vogue.

Hops have been used in brewing for so very long that we now always associate the flavour of this aromatic plant with beer. The real reason for its use is not, however, to be found in its flavour, but in its greater inhibitory action on the development of undesirable micro-organisms than on the true yeast. With the aid of the hop, a sound beer could be obtained; without it, a faulty product was almost inevitable. The hop plays a similar part in brewing to that which the natural acid of the grape does in wine-making, it is a selective antiseptic which renders the fermenting medium less suitable for the growth of bacteria than of yeast.

In countries where fermentation troubles were frequent, the addition of a substance capable of exerting an action similar to that of the hop in brewing has, from very early times, been a regular wine-making practice.

The resinous wines, still so much in favour in Greece, and which were so largely manufactured in ancient Rome, are in this connexion most interesting.

The semi-plastic, whitish exudation of the Aleppo Pine (*Pinus Halepensis*) is the form of resin used; it is added to the must before fermentation at the rate of 40 or 50 lbs. to the 100 gallons. It is previously worked into a thin paste with a little must, a small quantity of spirit being sometimes added to facilitate extraction.

Fermentation is slower in resined than in non-resined wines, and they are sounder and better protected against secondary fermentations. These wines are very largely made on the Greek mainland. According to M. Panayotis Pyrlas,* one of the delegates sent by the Greek Government to the Montpellier Viticultural Congress of 1911, they are much appreciated by Greeks and, as M. Pyrlas rather naively adds, even by foreigners, who, after a time, become accustomed to the resinous taste. They are consumed young, for they become bitter on keeping, owing to chemical changes taking place in some of the sub-

* *Progrès Agricole*, 12th March, 1911.

stances extracted. The resin in these curious wines plays the same part that the hop does in brewing.

Plastering is another warm country addition, with a similar object. This interesting process has never become popular in Australia, a fact on which, in the light of recent events, we may congratulate ourselves, but which is none the less curious, seeing that so many of our wine-making pioneers were recruited from parts of Southern Europe, where the practice has been so long current. In the warm countries bordering on the Mediterranean, plastering of wine has been common, at any rate, since the time of Pliny; it appears probable that in many of these it displaced the use of resin, the more cultivated western palate no doubt preferring a wine free from this foreign taste.

The object of plastering is the same as the addition of resin, namely, to make a sound wine in spite of fermentation difficulties. The process is simple; it consists in the addition to the grapes, when they are being crushed, of powdered gypsum or sulphate of calcium, either burnt or raw, at the rate of a few pounds to the ton of grapes.

The beneficial effect on fermentation, the mechanism of which was certainly not understood until recently, is mainly due to an increase in the proportion of tartaric acid in the must, at the expense of the cream of tartar, which, especially in over-ripe grapes, often prone to faulty fermentation, is so abundant that a considerable undissolved, crystalline excess, over and above what the juice is capable of holding in solution, is always present. A further beneficial action is to be found in the precipitation of certain albuminous matters, an excess of which is not uncommon in the grapes of warm climates. An improvement is also effected in the colour, which is rendered more brilliant, and the condition, which becomes more stable.

The action of sulphate of calcium on potassium bi-tartrate is explained by the following formula:—

$$2(KHC_4H_4O_6) + CaSO_4 = CaC_4H_4O_6 + K_2SO_4 + C_4H_6O_6$$

It follows that, in addition to the tartrate of lime, which, being insoluble, is eliminated in the lees, sulphate of potash is also formed. This salt, being soluble, remains in the wine, and though a normal constituent of all wines, it was the increase in this substance to a point which French hygienists considered excessive that led to the suppression of plastering. It is true that plastering somewhat modifies the flavour of the wine—Kulisch* has shown that as little as 0.02 gramme of potassium sulphate is sufficient to distinctly affect and impart a harsh character to the taste of wine. After lengthy investigation, the French Academy of Medicine decided, in 1891, that wines containing more than 2 grammes per litre of sulphate of potash were unwholesome for every-day use. Legislation was passed limiting the legal percentage of sulphate of potash to the above figure. Used in the reduced quantity required by the new law, the controlling effect on fermentation was so much reduced as to be of little service; plastering has in consequence fallen into disuse, at least in France, and those numerous countries whose pure wine legislation is based on French ideas. It is worthy of note that Sherry, one of the world's finest wines, is usually plastered to about twice the extent tolerated by

* *Weinlaube*; 44; 1899.

French law. The use of plaster seems indeed to be necessary in order to obtain the maximum of quality and character in this unique type of wine. Hygienists may well be expected to tolerate this slight excess; it is scarcely logical to fix the same sulphate limit for a special wine, of which an occasional glass is taken, as for a *vin ordinaire*, consumed in quantity.

Much perturbation was caused in Southern France by the suppression of plastering, and much inferior wine was made during the vintages which immediately followed it: in fact, until new methods, based on scientific research, came to the rescue. These proved far more potent for good than the old empirical methods, and though, for a few years, the giving up of the plaster which had for centuries regulated fermentation was looked upon as a serious and unnecessary hardship, it is now no longer regretted, and the quality standard of even the cheapest *vins ordinaires* is higher and more uniform than ever it was before.

The methods which superseded plastering were not, however, the first application of science in the domain of the wine-maker, and, if a logical sequence is to be observed, these must be held over for the present.

The above retrospect will serve to illustrate what has already been stated, viz., that in certain favoured regions the wine practically makes itself, the grapes and the factors governing their conversion into wine being all that could be desired; but that as regards the great majority of wines, especially in warm climates similar to ours, conditions are seldom perfect. Rectification of nature's shortcomings has long been found necessary, and it is by replacing such empirical corrections as the use of resin or plaster by more logical and far more efficient ones, that science has transformed the vintner's art, with truly remarkable results, in the direction of soundness and uniformity.

The aid of science was first sought in connexion with the correction of the composition of faulty musts, chiefly of those from immature grapes, by the addition of sugar; a simple specific gravity observation, indicating with sufficient approximation for practical purposes, the sugar strength of the must and the addition required. This and similar simple modifications are mentioned in the works of wine-making authorities published in the fifties and sixties of last century, except among few of the more progressive growers such teachings only very gradually found application in general wine-making practice.

Unscrupulous persons were more prompt to avail themselves of the advance of knowledge than honest wine-growers. Sophistications such as the stretching of the natural grape juice with sugar and water, were indulged in to such an extent that for a long time the very name of chemistry became objectionable in wine trade circles, in which it was looked upon as being more or less synonymous with fraud.

Pure wine legislation came to the rescue, sternly suppressing reprehensible manipulations, and thus entirely rehabilitating the application of science to œnology.

One of the earlier beneficial results of the teachings of chemistry was the use of tannin in Champagne making. This wine, which is largely made from red grapes, had to be very lightly pressed, if colour extraction was to be avoided, hence tannin deficiency, which entailed

insufficient precipitation of albuminous matters, and even viscous or "ropy" fermentation—in short, faulty wine. Chemists traced these evils to their true cause, and the logical use of tannin, which has ever since been one of the characteristic features of Champagne making, certainly ranks among the earliest practical applications of science in wine-making. The use of tannin spread to other wine districts until to-day this substance may be looked upon as an indispensable auxiliary in every cellar.

PASTEURIZATION.

To Pasteur is due the credit of having explained and perfected, rather than of having invented the method of preserving wine from

PASTEURIZING WINE IN A VICTORIAN CELLAR.

subsequent deterioration, which to-day bears his name. We may here recall the experiments of Spallanzani on meat extract in 1765, of Scheele on vinegar in 1782, and of Appert on food substances generally in 1810. Gervais, in 1827, and Vergnette-Lamotte, in 1840, extended the process to the preservation of wine; but their recommendations were not given effect to. Long before this, however, as early as the end of the 17th century, a process practically identical with pasteurization was generally used in Japan for the preservation of Sake, which could not previously be kept in drinkable condition through the summer months. Preservation by means of preliminary heating, an accidental discovery, proved a solution of the difficulty.*

* Dr. T. Takahashi, Professor at Tokio Imperial University. Article on the Brewing Industry in *Industrial Japan* 1912.

Pasteur was the first to explain that the deterioration to which wine is liable is caused by certain organisms, which in an acid and alcoholic medium such as wine are easily killed by brief exposure to a temperature of 60 degrees C. Pasteur took out a patent for the treatment of wine by heat in 1865, but generously allowed it to lapse. His classic work *Etudes sur le vin,* published in 1866,† describes several wine-sterlizing machines, rude, it is true, but the prototypes of the far more efficient appliances now obtainable. During the heating of the wine, contact with air must be guarded against, if modification of taste is to be avoided. This was the chief difficulty in earlier machines, but it has been overcome by improved construction. Nevertheless, a prejudice arose which is responsible, in a large measure, for the reluctance which still exists in some quarters, to adopt this most effective treatment. Professor Gayon, of Bordeaux, continued Pasteur's work. He has conducted investigations which have abundantly proved the advantages of pasteurization, and that, if properly carried out, the process cannot injuriously affect even the most delicate wines. His experiments were mainly conducted with bottled wines, and so far as these are concerned there can no longer be any doubt as to the efficacy of the process and the complete absence of any undesirable change in the wine treated.

Pasteurization in bulk has not proved quite so generally effective or satisfactory. When employed in an ordinary cellar, reinfection during the usual routine manipulations, is apt to defeat the object of the treatment. Some practical wine-makers take up the position that prevention is better than cure, and that the use of modern methods such as can render the medium more suitable for the development of desirable than of undesirable organisms, both during and after fermentation, renders pasteurization unnecessary; this is, in fact, what actually occurs in vineyards producing wines of highest grade in good seasons.

In spite of the marked improvements in the construction of wine-sterilizing machines, especially during the past twenty years, their use is by no means so general as might be expected. The process has not become, as was anticipated in Pasteur's time, a current cellar treatment, necessitating the presence of a pasteurizer as an indispensable part of the equipment of every cellar. These machines are, nevertheless, a most valuable adjunct, capable of saving many a wine which would otherwise become unmarketable; and, though they are not usually to be found in smaller cellars where operations are limited to the treatment of the produce of the vineyard, they are gradually forcing themselves into all European establishments where wine is handled on an extensive scale. In Australian wineries far more attention could, with advantage, be paid to the question than it at present receives, especially by our wine shippers, as was pointed out by one of us twelve years ago.

Though the adoption of pasteurization has been slow, even in Europe, it is nevertheless progressing steadily, and it certainly ranks as one of the most important scientific developments in wine-making.

† It is in the second edition of this work, published in 1872, that much space is devoted to wine sterilization by heat.

DISEASES OF WINE.

Pasteurization leads logically to the consideration of the organisms causing disease, the destruction of which is the object of the treatment. Following on the pioneer work of Pasteur, and more particularly in recent years, the diseases of wine have been extensively investigated, much attention being devoted to those caused by *anaerobic organisms, far more dangerous and difficult to guard against* than aerobic ones, against which the ordinary rules of good cellar management, such as cleanliness and frequent filling of casks, provide adequate protection.

Anaerobic diseases, the ones mainly to be feared in warm climates, present considerable interest in Australia; the importance their study has recently acquired in the Old World is in part due to the withdrawal of the protection afforded by plastering, when its suppression was decided on in 1891, but even in greater measure to the vast extension of Algerian wine production. Here fermentation problems, mainly connected with low acidities and high temperatures, presented themselves in a more acute form than on the northern shores of the Mediterranean. The climates of Northern Victoria and Algeria being so similar, the knowledge gained in the latter country is of very real value to us. Improvement in the average quality of Australian wine which is so marked a feature of the industry to-day is mainly due to the application of recent teachings of French and Algerian œnologists, our indebtedness to whom must here be gratefully put on record.

A remarkable feature in connexion with wine diseases of the anaerobic class is the difficulty which has been experienced in the way of isolating a special organism, responsible for a given, well-characterized disease. Scud, or *tourne,* the closely allied *pousse,* the bitter disease of Burgundy, and ropiness, or *graisse,* are quite distinct in the modifications they cause in the taste of the wine, yet the organisms responsible for them all induce mannitic fermentation when placed in a solution containing levulose, such as the juice of the grape. As Bouffard pointed out at the 1911 Montpellier Congress, these different diseases appear to be caused by closely connected, if not identical, germs—the different changes of the wine depending rather on the initial composition of the liquid. The same microbe in different wines would bring about different changes.

The intricacy of the question and the incomplete state of our knowledge concerning it can only be mentioned here. So far as the practical wine-maker is concerned, he will do well to remember, in a general way, that *all micro-organisms, other than yeast, are potentially dangerous.* In the picturesque words of Bouffard,* so far as the vine-grower is concerned, "The fear of microbes is the beginning of wisdom." Let him guard against their appearance by rendering the medium as unsuitable as possible for their growth by such means as we shall consider presently, and destroy them by pasteurization should they develop. Such is the mandate of science to the wine-maker.

Reference must also be made to the diseases known in France under the collective name of *casse,* so called from the breaking up of the colouring matter. This modification is brought about by an

* *Congrès Viticole de Montpellier,* 1911.

enzyme termed Oxydase, more especially plentiful in grapes damaged by moulds. Sulphurous acid proved of great service in combating *casse*. It was its experimental use in this connexion which led to the evolution of the wine-making method known as sulphiting.

PURE YEASTS, OR "LEVURES."

The substitution of pure cultures of selected yeasts for natural yeast, present at vintage time on the skin of the grape, being the ultimate outcome of Pasteur's epoch-making investigations, may be considered next, in spite of the fact that its general adoption is only now beginning to make itself felt as a regular wine-making method.

Many years have elapsed since the art of the brewer was revolutionized by the application of the technically simple methods first advocated by Pasteur, and perfected by his successors Hansen, Wörtmann, and Jorgensen. The application of similar methods in the sister art of wine-making was only a matter of time, and rather more than twenty years ago the propagation and trade in selected wine yeasts was, for a time, a profitable industry in France. Those interested in the sale of such cultures claimed that their use would transform wine-making, permitting the production of the choicest wines from good ordinary must, provided the appropriate yeast were employed. As was inevitable, these extravagant hopes were disappointed, with the regrettable result that selected yeasts were discredited and their use almost abandoned for many years.

In scientific circles they continued to receive attention. Thanks to the investigations of Kayser, Rosentiehl, Fernbach, Martinand, Jacquemin, and others, the causes of earlier non-success were explained, and the use of pure yeasts was at length placed on a sound basis. Progress, though slow at first, was none the less sure. From the laboratory the new method gradually spread until, to-day, "Levured" wines are made in France by millions of gallons.

The difficulty experienced in supplanting the native yeast by the pure culture was the main reason for the non-success of early experiments; in the greater majority of these the added yeast can have taken little or no part in the fermentation. Preliminary sterilization by heating, though it gave encouraging results, was not practical on a large scale, and it is mainly due to the general extension of "sulphiting," a process which will be considered presently, that full advantage can now be taken of the use of pure yeasts in wine-making.

Though the advantages gained fall far short of early expectations, they are none the less considerable. They may be briefly resumed as follows:—Increase in alcohol production, due mainly to the absence of sugar waste by wild yeasts. Improved "condition" of the resulting wine owing to more rapid and complete yeast precipitation. Resistance to adverse conditions, such as high temperature, a large percentage of tannin or of alcohol in the case of high gravity musts. Even as regards production of bouquet, an improvement is generally admitted.

The progress already achieved in the use of pure yeasts constitutes a distinct œnological advance, though there are still problems to be solved, such, for example, as the suiting of the yeast to the grapes one has to deal with, a point apparently of importance in connexion with the production of bouquet. It is also reasonable to ask, in view of

the variety of organisms present in natural fermentations, whether symbiosis may not play a part in fermentation.

TEMPERATURE CONTROL DURING FERMENTATION.

In this, perhaps, we have the most important modern development, especially as regards the making of wine in warm climates. It has long been known that the quality of the wine suffers if the temperature, during fermentation, exceeds a certain point. In cooler wine regions, such as those of Central France, dangerous temperatures are rarely, if ever, experienced, hence the small amount of attention the question has received until recently. It is, indeed, the spread of vine-growing in Algeria to which we are mainly indebted for the attention the question has recently received. It is worthy of note, however, that the late Dr. A. C. Kelly, the well-known South Australian vine-grower, in his work *The Vine in Australia*, published in 1841, devoted considerable attention to temperature control during fermentation. He, in fact, describes a refrigerator which he had actually employed, but the use of which was afterwards discarded, owing to the fear that the metal of which it was constructed might injuriously influence the wine. Dr. Kelly's remarks, especially in view of more recent developments, are exceedingly interesting. There can be no doubt that had his teaching received more attention at the time, Australian viticulture would have benefited to an enormous extent.

The optimum temperature for yeast, or that at which it shows its maximum of activity in the direction of sugar transformation, appears to be between 30 and 35* degrees centigrade. A temperature curiously close to that at which it begins to suffer, 38 degrees being looked upon as the point beyond which yeast undergoes deterioration. In practice it has been found necessary to keep considerably below the optimum temperature, at least in the early stages. Fermentation is an exothermic reaction liberating a considerable amount of heat; the exact amount does not seem to be accurately known. The most recent researches on the subject appear to be those of Bouffard,† who by direct experiment found that 180 grammes of sugar dissolved in a litre of water was capable, during fermentation, of liberating 23.5 calories. This is appreciably less than the 32.07 calories given by calculation. The actual amount of heat released will probably be found somewhere between these limits. The temperature of the fermenting mass must increase unless this heat be removed, either artificially or by natural radiation, as actually occurs in cool climates; otherwise it accumulates until temperatures fatal to yeast are reached, with disastrous results to the constitution of the wine. Not only is the yeast killed by the elevation of the temperature, but even before this occurs, owing to life under unfavorable conditions, it behaves differently from what it does in normal growth, and excretes substances injurious to its further healthy development, even if temperatures are subsequently lowered. Wine produced at high temperatures contains a larger proportion of volatile acidity, and also retains albuminous substances in abnormal quantity, with the result that it not only clears with greater difficulty, but is more suitable for the

* 86° and 95° Fahrenheit.

† *Comptes Rendus de L'Academie des Sciences*, Paris, 12 Aout, 1895.

life of injurious organisms, such as bacteria. Temperatures dangerous to yeast are also eminently suited to the development of injurious bacteria. Thus fermentation at high temperatures not only directly encourages the invasion of the wine by disease organisms during the time the temperature is excessive, but also by supplying food for their ulterior development. One of the most dreaded disease organisms is the mannitic ferment, which produces mannite at the expense of levulose. Mannite, though an unfermentable sugar, is a very suitable food for many disease organisms. As we have already seen, there is every reason to believe that the mannitic ferment itself is capable of bringing about ulterior changes of varying kinds. The complicated mechanism by which high fermentation temperatures injuriously affect the wine cannot be fully gone into here.

Different methods of refrigeration have been recommended. Our Northern vine-growers generally use tinned-copper coils, through which cold water circulates, after the style of the attemperators which have so long been used in breweries. In Algeria, exterior coolers of the Lawrence type are favoured, the wine being withdrawn from the vat and returned to it after having been pumped through the cooler. It will suffice here to say that temperature correction has absolutely transformed the wines of the hot countries where it has been applied.

Semichon* describes how Algeria, "which formerly produced wine with such a bad name, now produces perfect wines; even preferred by the trade to many French wines. Scarcely ten years ago, when one detected in a blend the sour-sweet taste, which we know to be caused by fermentation at high temperatures, it was invariably agreed that it had an Algerian taste!"

The substitution of cement fermenting vats for the wooden ones formerly used has done much to reduce temperature troubles. Being a better conductor, heat is more readily lost through radiation and conductivity, especially at night time. These, as well as stone vats, which present similar advantages, have long been used in the warm wine-making countries of Europe, such as Spain and Portugal. Their introduction into the cellars of Northern Victoria, which took place over twenty years ago, was immediately followed by a marked improvement in the quality of the wines made, an improvement which was considerably accentuated when, a few years later, temperature control became general. The transformation of Australian wines has been quite as striking as that described by Semichon in Algeria, and it is this improvement which has mainly contributed to the development of our now extensive export trade in wine to England. It is a noteworthy fact that, whereas the imports of all other wines into the Mother Country have generally declined during the past twenty years, those of Australia alone show an increase.

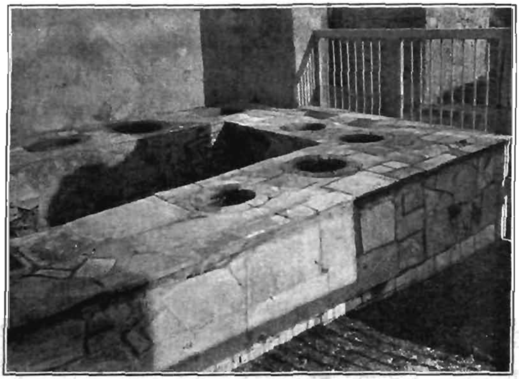
SUBSTITUTES FOR PLASTERING.

We have already seen that the suppression of plastering created a certain amount of consternation in the countries where its benefits had long been taken advantage of, hence the introduction of several substitutes, one of which—the use of bi-calcic phosphate—was somewhat largely practised. The addition of this salt to the crushed

* *Semichon, Traité des Maladies des Vins.*

grapes brings about a somewhat similar reaction to that of plastering. The acidity is increased, and phosphate, instead of sulphate of potash, becomes present in the wine. Phosphate not being open to the same objections, its presence was permitted by pure wine legislation. The process still has partisans, though it has been rendered unnecessary by several more desirable methods, notably sulphiting, which will be shortly referred to. Several other substitutes were also tried with varying success.

In the correction of acidity, however, we find by far the most logical substitute for plastering; in the case of warm-climate grapes, so often deficient in natural acidity, it is most strongly to be recommended. Seeing that plastering acts by releasing tartaric acid, it was only logical to add this substance directly to the must. Such



A WINE SHOP—A.D. 79.

A "Cantina" in Pompeii—The circular apertures in the marble counter served to hold the pointed ends of the earthenware *amphorae* from which the wine was served to customers.

direct addition is, of course, completely under the control of the wine-maker. The same results may be obtained by other methods, such as the blending in of a proportion of unripe grapes, or the picking of the main crop somewhat earlier, and before the acidity has fallen to too low a point. These methods, though useful, are not always quite suitable in Australian cellars, especially for the making of the full-bodied export wines demanded of us in London and in order to make which, considerable maturity of the fruit is indispensable. That the acidity of Australian grapes is often low was pointed out by one of us in the paper read at the Adelaide meeting of the Australasian Association for the Advancement of Science in 1893.

Fermentation troubles arising from insufficient acidity lead to the seeming contradiction that, within certain limits, the less acid the

grapes, the more acid the resulting wine. The acids which develop during and after fermentation belong to a totally distinct class from those naturally present in the grapes. They are characteristic of unsoundness in wine, and their presence in appreciable quantity renders it not only undrinkable, but unfit for conversion into brandy, or even good vinegar.

YEAST STIMULATION.

In addition to its carbo-hydrate food, yeast, like other plants, requires nitrogen and mineral substances. The artificial increase of these, which may be compared to the manuring of higher plants, has proved a valuable means of aiding fermentation. Potash is, of course, abundantly present in the shape of cream of tartar, but nitrogen and phosphoric acid are much less plentiful. Unlike higher plants, yeast readily assimilates ammoniacal nitrogen, but it cannot absorb nitrates. Phosphate of ammonia is thus indicated for the purpose. Its use has proved most beneficial as a stimulant to fermentation. In Australia, such yeast stimulation assumes even greater interest, especially for the production of wine of the export type where fermentation has to be pushed to a degree unknown in Europe. The results obtained, so far, have been most striking.

SULPHITING.

By this term is understood the addition of sulphurous acid to the must during fermentation as a means of regularizing and controlling it. The use of sulphurous acid in wine cellars dates from antiquity, and it is, at the present time, the only antiseptic permitted in wine. For this purpose its addition was generally made subsequently to fermentation. In the later nineties of last century several experimentalists, among whom may be mentioned Rocques, Müller-Thurgau, Andrieu, Dupont, Ventre, and others, tried the influence of this antiseptic *during* fermentation. The results were startling, and have gradually led to the evolution of a process which is undoubtedly the most striking wine-making development of modern times.

Sulphurous acid exerts its action mainly through its antiseptic influence on the different micro-organisms contained in the fermenting mass, which is more severely felt by injurious bacteria than by yeast. Even on yeast it exerts an important selective influence, hindering undesirable to a greater extent than useful types. Sulphiting has absolutely compensated the wine-growers of warm countries for the loss of plastering. Not only is it far more effectual, but it presents nothing contrary to Australian and European pure wine legislation, the sulphurous acid being a temporary antiseptic which disappears after having exerted its regularizing effect on fermentation.

Sulphiting also assists materially in the direction of temperature control. By retarding the early impetuous start of fermentation it increases the chances of natural loss of heat through radiation, where this is possible, and gives more time for the execution of refrigeration, if it must be resorted to. In this connexion its use may be looked upon as amounting to chemical cooling by retardation of the rate of fermentation.

Sulphurous acid may be added to the crushed grapes in several different forms. They may be made to absorb the gas resulting from

the combustion of sulphur. Sulphur dioxide may be added either in the liquefied form, in concentrated aqueous solutions, or in the combined state as bi-sulphite of potash. The latter is, perhaps, the most convenient form, and it is the one which has given the name to the process, but the direct introduction of liquefied sulphur dioxide now tends to displace it in France, being cheaper and, now that ingenious measuring devices are obtainable, just as convenient. The dose varies from 10 (ten) to 15 (fifteen) grammes of sulphur dioxide per hectolitre ($1\frac{1}{2}$ to $2\frac{1}{4}$ ozs. per 100 gallons).

During the past two years sulphiting has been strongly urged on Victorian vine-growers by one of us. It has been extensively applied with most gratifying results, and is firmly establishing itself as a regular wine-making method in Australia.

THE "VINERIE" SYSTEM

Is the logical outcome of sulphiting. Briefly described, it consists in the sterilizing of the grapes as soon as they are vintaged and crushed, with a sufficient dose of sulphurous acid to render fermentation impossible. They can then be stored until such time as suits the wine-maker, and fermented at leisure, after the removal of sulphurous acid by the operation known as de-sulphiting, under most suitable conditions as regards temperature and cellar care.

In the ordinary course of events, vintage is a time of stress and bustle, a time of emergency, hence often embarrassing for the carrying out of so delicate an operation as fermentation. The "Vinerie" system obviates all this, and puts wine-making on a somewhat similar footing to brewing. The crop is harvested as rapidly as may be desired, but its transformation into wine is carried out as deliberately and methodically as the manufacture of beer. The adoption of the "vinerie" system will undoubtedly lead to the industrialization of wine-making, the advantages of which in the direction of evenness of type, reduction in cost of handling, and several other ways are obvious. The credit for this latest innovation appears to be mainly due to Barbet, the well-known authority on distillery equipment. De-sulphiting, or removal of sulphurous acid, is performed in a column, analogous to the rectifying column of a still, in which the bubbling of air through the liquid, under reduced pressure and at a temperature of about 70 degrees C., is capable of removing practically the whole of the sulphurous acid. At the "vinerie" of Misserghin, in Algeria, where half a million gallons of wine were made last year by the new process, the de-sulphiting column is made of earthenware. So far as white wines are concerned, the process, as might be anticipated, has given most excellent results. In the case of red wines, there are yet problems to be solved. Some authorities prefer three or four days' maceration previous to pressing, during which colour and tannin are sufficiently extracted, sulphurous acid really acting as a solvent. Though it transforms the colour to such an extent that it is apparently destroyed, it reappears in a more intense form than ever on the elimination of the sulphurous acid. Other authorities separate the juice immediately and ferment it into white wine, with which they afterwards extract the colour from the preserved skins. Several important "vineries" have already been established in Europe and

Algeria. Although there may be a few minor problems yet to be worked out, results obtained have amply fulfilled expectations, and the method will undoubtedly be enormously extended within the next few years. One direction in which it shows great promise is for the manufacture of unfermented wine, a beverage which should find more favour than it does with those having conscientious prejudices against alcoholic liquors. Pure grape juice, though too sweet by itself, is, when diluted with water or sodawater, an agreeable, wholesome, and thirst-quenching drink, far preferable to the artificially flavoured and coloured cordials so extensively consumed.

CONCLUSION.

Enough has been said to show that wine-making at the present day is something entirely different from what it was a quarter of a century ago; more especially during the past few years very considerable progress has been made, and though there are yet problems awaiting solution, we can claim to have reached the stage when, thanks to the teachings of science, there is no longer any excuse for the making of unsound wines. Of course, the paramount influence of soil and situation will continue to make itself felt, and those vineyards which have long shown their natural superiority will, no doubt, continue to do so.

It will be noted that the *rôle* of science is to prevent, and not to cure, the various diseases to which wine is liable, and surely such progress is on the soundest lines. A faulty wine is almost valueless, and cannot by any treatment be made properly marketable. Science has taught the wine-maker how to make the best possible wines from the grapes at his disposal, even under adverse conditions.

The train of research initiated by such master minds as Pasteur and Liebig has borne abundant fruit. The innovations in wine-making practice which are its logical outcome have revolutionized the industry, which, even from so material a motive as self-preservation, is henceforth compelled to avail itself of the teachings of science.

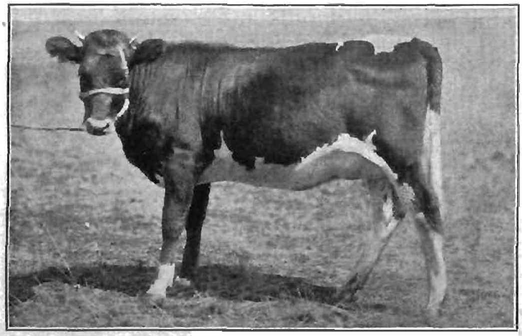
A PRECOCIOUS CALF.

By R. T. Archer, Senior Dairy Inspector.

When visiting the farm of Mr. Wm. Kerr, "Leura," Camperdown, my attention was drawn to the remarkable udder development of a seven months' old black and white cross-bred calf three-quarters Jersey. On investigating the development, it was found that the calf was secreting apparently normal milk. The development had been noticed some time prior to my visit, and it is probable that the calf had milk at six months old or sooner. The accompanying photographs were taken at nine months old, when she was yielding 5 lbs. of apparently rich milk once daily on scant pasture in the middle of summer. One can reasonably assume that had she been well fed and milked twice daily the yield would have been much greater. We

know that a calf's start in life is no haphazard affair, but is rigorously determined by its ancestors for some generations. Each individual calf is the embodiment of the successes achieved by its ancestors. Such

being the case, the young heifer under review has every promise of being a splendid dairy animal, for her grand-dam is "Linda," winner of the butter test at the Camperdown Agricultural Show in



1907, yielding 45¼ lbs. of milk and 2.70 lbs. of butter daily, or at the rate of nearly 19 lbs. weekly. This cow was a Jersey-Ayrshire cross, and although having only three teats (the other teat was cut off

by barbed wire when a heifer), produced on home performances up to 56 lbs. of milk daily in the spring time. She was a consistent milker, and on one occasion milked right through the lactation period without a spell. Her dam, "Linda II," is a strawberry-coloured cow showing a little of the Ayrshire strain, and is of splendid dairy type. This cow generally calves in the autumn, and consequently does not make the high daily record that spring-calved cows do, but in May, 1910, her daily yield was 35 lbs., 5.2 test, being 2.11 lbs. butter, or nearly 15 lbs. weekly. She was still milking well when the calf's photo. was taken in January, nine months after birth. The heifer under review was sired by a pedigreed Jersey bull, the dam of whom won the Jersey Female Championship at the Grand National Show, Colac.

While maternity is the prime cause of secretion, it is not the only means of stimulating the activity of the udder. The regular removal of saline fluid in the gland of the virgin animal or even the stimulation of the organ by the sucking of a calf is sometimes sufficient to cause the secretion of milk of normal character in considerable quantities. The phenomenal udder development and the subsequent large milk flow of this young heifer were caused by the sucking of another calf. When this was noticed the calves were separated, but the amount of milk in the calf's udder necessitated milking it daily, with the result that the flow is increasing. The heifer is very well-grown, and shows no ill-effects of the continual milking. A sample of the milk has been collected and analyzed by the Chemist for Agriculture, and the table appended shows that the fat and milk sugar are present to a slightly greater extent than is usual. For purpose of comparison, the analysis of normal milk is also given:—

Report on analysis of sample of milk from Mr. Kerr's calf—

Total solids	15.10	per cent.
Ash	.65	"
Total proteids (N x 6.25)	3.39	"
Fat	6.00	"
Milk sugar	6.72	"

Normal cow's milk—

Total solids	13.0	per cent.
Ash	.75	"
Total proteids	3.5	"
Fat	4.0	"
Milk sugar	4.75	"

EFFECT OF FORMALIN AND BLUESTONE PICKLE ON THE GERMINATION OF WHEAT.

By C. C. Brittlebank, Vegetable Pathologist.

The following experiment was undertaken with a view to ascertain the effect of time upon the germination of wheat after treatment with formalin and bluestone solutions:—Federation wheat of the previous

harvest was used throughout the test. A sufficient quantity was obtained and divided into three equal parts, one being set aside as a control and the other two parts being pickled, one in a solution of formalin, 1–300, for a period of five minutes, and the remaining portion in a 2 per cent. solution of bluestone for one minute. After pickling, the seed was thoroughly dried and placed in clean calico bags.

As it was important that the conditions during the germination of the control and pickled wheats should be comparable one with another, they were, as far as possible, carried out with this in view. The method adopted being as follows:—Sheets of white blotting paper were folded once along their length and then at right angles gathered into a number of pleats or folds, Fig. 1. One hundred grains each of the control and treated grains were then placed in the troughs of their respective papers, which were then placed in a shallow porcelain dish, into which water at 70° F. was poured until the papers were thoroughly soaked. The surplus water was then drained off, and the dish covered with sheet glass and allowed to remain at room temperatures. A period of twelve days was given for germination of the grain, but a shorter period would suffice, as the sound grains had sprouted and appeared above the folds of the paper within from seven to eight days.

From the first there was a marked difference in the vigour and growth of the plants. As might be expected, the control was the quickest to germinate, and the most vigorous and luxuriant in subsequent growth. Germination percentages being between 92 per cent. and 99 per cent. during the experiment, or an average for the 54 weeks of 95 per cent.

The next in germination and vigour was that pickled in formalin solution, which gave as the result of the test an average over the 54 weeks of 91 per cent. All through the test the seed treated with bluestone pickle could be detected, being greatly behind the control and formalin-treated seed—Fig. II.

In referring to the table, it will be noticed that the germination of seed treated with formalin solution fell off after the first week, and continued to do so to the end of the sixth week, after which there was a rise in the percentage of germination to the ninth week. When there was another fall, followed by various fluctuations in germination to the end of the fifty-fourth week.

The highest percentage of germination in the bluestone pickled wheat was 95 per cent. at the end of the first week, following which there was a more or less gradual fall, reaching 32 per cent. at the end of the experiment.

Table I shows the various fluctuations from the first week to the end of the fifty-fourth.

As it is not possible to arrive at conclusions from any single experiment, similar work will be carried on during the present year. The conclusion derived from the above experiment, is that seed should be sown as soon as possible after treatment, which is the practice adopted by growers generally.

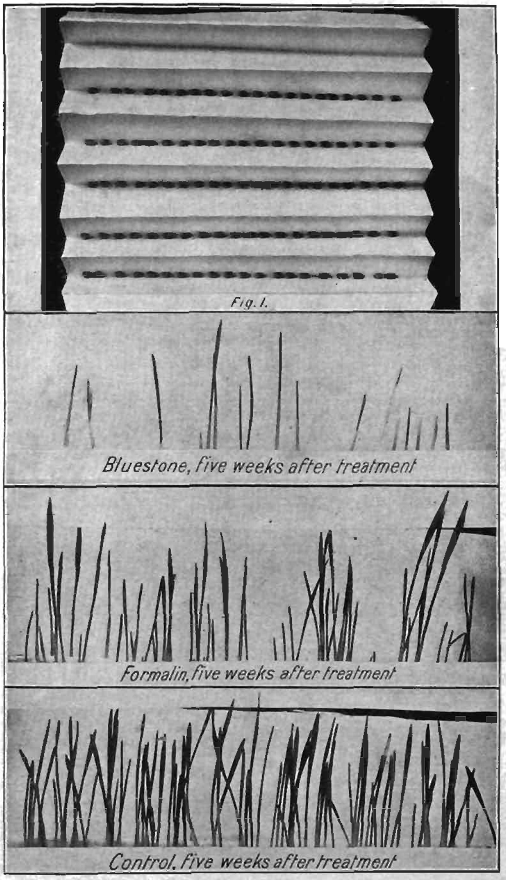


Fig. 1.
Bluestone, five weeks after treatment
Formalin, five weeks after treatment
Control. Five weeks after treatment

Fig. 2.

TABLE I.

Number of Weeks after Treatment.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Control, per cent. germinating ..	98	99	98	98	98	99	98	97	98	97	97	98	98	95	98	97	96	98	98	96	97	95	95	97	97	95	92	95	93	94
Bluestone, ...	95	92	92	85	76	72	71	68	68	71	68	62	54	52	61	46	62	44	56	44	45	42	42	41	43	43	41	42	41	41
Formalin.	93	93	93	92	93	98	97	97	98	95	93	93	92	89	90	93	93	85	92	93	92	90	90	95	95	94	93	93	93	92

Number of Weeks after Treatment—*continued.*

	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	Average total germination for 54 weeks—
Control, per cent. germinating ..	93	92	94	92	91	92	97	92	92	92	92	93	94	92	93	92	94	93	93	93	92	95	93	94	95 per cent.
Bluestone, ...	40	41	44	40	40	41	38	40	37	37	34	35	34	36	34	35	38	35	37	30	35	32	33	32	48½ ..
Formalin.	90	90	90	91	90	89	90	90	90	92	90	91	90	90	89	87	87	86	88	86	88	87	85	84	91 ..

Control—No. of grains tested ..	5,400	Bluestone—No. of grains tested ..	5,400	Formalin—No. of grains tested	5,400
" " " germinating ..	5,131	" " " germinating ..	2,613	" " " germinating ..	4,919
" " " not germinating ..	269	" " " not germinating	2,787	" " " not germinating ..	481

RICE-GROWING FOR VICTORIA.

RESULTS OF INVESTIGATIONS IN CORRESPONDENT CONDITIONS AS REGARDS CLIMATE AND SEASON IN SACRAMENTO VALLEY, CALIFORNIA, U.S.A.

[Several inquiries as to the feasibility of rice-growing in Victoria have been made to the Department from time to time. Except in one instance the growing of rice has not been attempted in Victoria, and as there was therefore no practical experience available, recourse was made to the United States Bureau of Plant Industry, whose Agronomist-in-Charge of Rice Investigations, Mr. C. E. Chambliss, kindly furnished me with his most recent report, "A Preliminary Report on Rice-growing in the Sacramento Valley," published last year.

Seeing that the conditions which led to the investigations detailed in the report are practically such as are now existent on certain of the Northern lands of the State available to irrigation, opportunity is taken to publish the report in full, so that those interested may judge for themselves of the possibility in their circumstances of undertaking trial areas with reasonable prospects of success. In applying the information in Mr. Chambliss' report to local conditions, the reverse seasons of the Northern Hemisphere need to be continually borne in mind.—Editor, *Journal of Agriculture,* Victoria.]

A PRELIMINARY REPORT ON RICE-GROWING IN THE SACRAMENTO VALLEY.

By Charles E. Chambliss.

Introduction.

In the Sacramento Valley of California there are large tracts of land that 30 years ago produced profitable crops of wheat and barley which are now not yielding crops of either grain in paying quantities. These tracts were first used for grazing cattle, but were afterwards converted into extensive grain ranches, which to-day might be as remunerative in yield as in the earlier days if maintenance of soil fertility had been valued as an asset. Under improved methods of farming, however, a large part of this area, depleted as it is in plant food, will still produce grain in quantity and of good quality at a profit. While crop rotation, diversified farming, and intensive culture will play conspicuous parts in the improvement of the agriculture of this valley, irrigation will play a more important part in the development of its agricultural possibilities, for through the intelligent use of water it is possible to obtain the full capacity of the crops now grown, and also profitable returns from crops which are not now cultivated in this valley.

Among the crops requiring water rice is worthy of a trial, but its successful cultivation is so dependent upon water that it should never be planted where the supply is not sufficient to submerge the land to the depth of at least 3 inches from the middle of June to the middle of September. If there is water enough during this period for a continuous submergence, the greatest obstacle to the production

of the crop is removed. There is no crop grown in California at present that requires so much water as rice.

CONDITIONS UNDER WHICH VARIETY TESTS OF RICES WERE MADE.

In the spring of 1909, the Office of Grain Investigations of the Bureau of Plant Industry inaugurated tests to determine the adaptability of rice to the climate and soil of the Sacramento Valley. These tests were made on the black adobe soil lying on the east side of Butte Creek (approximately 9 miles west of Biggs. Cal. (Pl. I., Fig. 1). This soil is of a close, compact structure. When wet it has an exceedingly tenacious and putty-like consistency. During the dry season it breaks at the surface into blocks with deep fissures between them. These blocks upon long exposure are divided and subdivided by smaller fissures until the surface may become a loose, shallow mass of small pieces of the size of peas. In this condition the soil absorbs water readily, which is given up slowly under evaporation. The subsoil, which lies at a depth of approximately 3 feet. is very impervious, though water penetrated it to a depth of 6 inches before the plats were drained. The surface of the plats was nearly level, with just enough slope for good drainage into the narrow sloughs, which are features of the topography of this area of black adobe that may be used for conveying water for both drainage and irrigation.

Grain had been grown exclusively upon this land, though it was not under cultivation during the year preceding the tests. The land was ploughed in the autumn. The rains of the winter months reduced the clods and left the surface of the soil in a condition that required less work and expense to secure a good seed-bed than would have been possible if the entire preparation for planting had been postponed until spring.

The seed of each variety was planted with a drill to the depth of 1½ to 2 inches at the rate of 80 pounds per acre. On account of a lack of moisture in the soil at the time of planting, it became necessary to apply water to germinate the seed. This irrigation is not likely to be required when the planting is done immediately after the late spring rains or before the end of the rainy season. It would not be advisable to plant early except on well-drained land that had been ploughed in the autumn.

In the first irrigation the water was retained long enough to wet the surface of the soil thoroughly. The second application of water was made when the plants were approximately 3 inches high, which was sooner than would have been necessary if the soil had not become too compact on the surface when the plats were drained. From this period water was applied every seven to ten days to keep the soil moist. After the plants had tillered well the land was submerged to a depth of 3 to 5 inches. This submergence was continuous until the grain reached the hard-dough stage. At this stage of maturity the plats were drained for harvest. All varieties were allowed at least ten days in the shock before they were thrashed.

From the date of planting until 1st October there was less than 1 inch of rain. During the same period the average daily range of

temperature varied from *29° in May to †38° in August, with the greatest range occurring in July, August, and September.

Table I.—*Results of variety tests of rices*[1] *grown upon one-tenth acre plats on black adobe soil in the Sacramento Valley of California in* 1910.

G. I. No.	Date planted.	Date land was submerged.	Date of maturity.	Days to maturity.	Height of plant, including head.	Length of heads.	Heads per plant.	Yield per acre.[2]
					inches.	*inches.*		*bushels.*
1533	Apr. 12	June 25	Oct. 22	193	38	7·0	6–12	71·5
1561[3]	Apr 13	do.	do.	192	36	7·5	7–21	154·0
1562	do.	do.	Oct. 1	171	40	7·5	7–10	131·3
1563	do.	do.	Sept. 29	165	40	7·0	6–14	122·4
1582	do.	do.	Sept. 2	142	31	7·0	8–22	42·8
1583[3]	do.	do.	do.	142	33	7·0	8–15	47·1
1585	do.	do.	do.	142	31	6·5	8–22	58·0
1597	Apr. 12	do.	Sept. 7	148	28	6·5	5–14	71·3
1599	Apr. 13	do.	Sept. 2	142	33	7·0	8–15	23·1
1600	do.	do.	Sept. 30	170	38	7·0	6–11	94·6
1602	do.	do.	Sept. 25	165	36	7·0	9–20	77·7
1642[3]	Apr. 12	do.	Oct. 22	193	29	7·0	10–27	124·0
1643[3]	do.	do.	do.	193	38	7·5	6–12	63·3

[1] These rices, on account of the quality of their grain, were selected for planting in 1910 from 300 varieties which were grown here in 1909 on plats consisting of only 4 rows a rod each in length and 7 inches apart. The yields from the rices of 1909 were relatively much higher than in 1910, when the plantings were made on a larger scale. Estimated upon the actual yield from plats one-half acre in size, the Wataribune (G. I. No. 1561) and Shinriki (G. I. No. 1642) varieties in 1910 yielded 113·7 and 137·2 bushels per acre respectively.

[2] Estimated upon the actual yields from one-tenth acre plats.

[3] See illustrations.

In this valley these rices require a longer time to mature, and they produce smaller plants than when grown on the plains of the Gulf coast, but they exhibit a greater capacity for tillering, with resultant larger yields.

Fig. 1.—General view of Rice Plats on Black Adobe Soil in the Sacramento Valley of California.

The short-grain rices appear to be better suited to this climate than the long-grain varieties (Fig. 2). They ripen more uniformly,

* Fah. 84·2. † Fah. 100·4.

though slowly, tend to shatter less, and produce larger yields. There is less sun-cracking of the grain in these varieties after ripening than in the long-grain rices, which will result, of course, in a larger percentage of head rice when milled.

The number of days for maturing the crop may be greatly lessened by stimulating the growth at the time the plants begin to "boot" by increasing the depth of water (Fig. 3), with a gradual lowering of it during this period, and by giving another impetus to growth by suddenly increasing the depth of water just as the heads appear. This last depth of water should be maintained until the heads begin to turn down, when the land should be drained for harvest. A shorter season and earlier planting seem desirable in order that the crop may escape the effects of the increasing humidity in September and October, which appears to lengthen the period of ripening.

The Honduras (Fig. 4) and Shinriki (Fig. 5) varieties (G. I. Nos. 1643 and 1642) are the leading commercial rices of the

Fig. 2.—A Plat of the Lencino variety of Rice (G.I., No. 1583) in flower. During this period the land is submerged.

United States. In this test these varieties have exceeded the maximum yields produced on experimental plats in Louisiana and Texas. Of the two rices, the Shinriki, which is a small-grain variety, is better adapted to the Sacramento Valley.

The Wataribune (G. I. No. 1561) (Fig. 6), the Oiran (G. I. No. 1562), and the Shinriki (G. I. No. 1642) varieties produce good yields, but on account of the long period which they require for maturity they may never become the leading rices of this valley, because the late planting of them might result in the loss of a crop. For this reason, early-maturing varieties of good quality, though producing less per acre, might be more remunerative. The other varieties included in Table I are introductions from foreign countries that will be described and discussed in a later publication.

Suggestions as to Methods of Culture.

In selecting land for rice it is very important to know whether the subsoil possesses the mechanical characters for retaining water, for in the irrigation of this crop a continuous submergence of the land

for several weeks is required. Such a condition is not possible unless the subsoil is sufficiently impervious to water, or unless, by tidal irrigation, the depth of water upon the land may be maintained continuously when needed, regardless of the nature of the underlying stratum of soil. On land that cannot be flowed by the tides the cost of submergence and the time required in the submergence depend upon the depth of the soil. A soil with a depth of 20 inches is preferable to a deeper one, because less water will be used and less time consumed in flowing the land. However, heavy clay soils of great depth that can be well prepared and drained may be used advantageously for the crop, but comparatively shallow soils must be underlain by an impervious subsoil or so located as to be subject to tidal overflow. These details of irrigation, an item of great expense in the production of rice, must be considered to secure maximum returns.

Fig. 3.—A Plat of the Wataribune variety of Rice (G.I., No. 1561) in "Boot." During this period land is submerged.

Soil of a compact nature seems well adapted to rice. Clays, for this reason, if they are not too deficient in organic matter and can be effectively drained, are preferred to other soils, because they dry out more readily at the surface and become solid after the removal of the water, making the fields accessible at harvest much sooner than would be possible on the more open soils. The culture of rice, however, is not confined to clay soils, for wherever water can be economically handled by irrigation and drainage loamy and even sandy soils will produce good crops.

When not contrary to good farm management and the nature of the soil will permit it, land for rice should be ploughed in the late autumn and well drained. With good drainage at this time the alkali which has accumulated just below the surface will be washed out by the winter rains. Furthermore, the action of the weather during the dormant period will have the effect of pulverizing the soil and making possible a good seed-bed at a minimum cost. If ploughing is postponed until spring, the land should not be left in

furrow, but should be harrowed at once and not allowed to dry out before planting. High germination and vigorous growth of the young plants are dependent upon a good seed-bed. The importance of its preparation cannot be emphasized too strongly.

The seed may be drilled or broadcasted. Large, heavy, flinty seed, *uniform in size and free from sun cracks, should be used.* The cracking of the grain by the sun occurs when the plants are allowed to stand too long after ripening or when the heads of rice are exposed in the shock. In thrashing and in cleaning by a fanning mill, grains are often cracked, but this may be easily prevented by the proper adjustment of the machinery. This imperfection in the seed is not easily detected, because the husk which envelops the kernel remains attached when the grain is thrashed. Sun-cracked and machine-cracked seed will not produce vigorous plants.

The seed should not be sown deeper than 1½ inches. In a well-prepared seed-bed a less depth is desirable if the proper conditions of moisture exist. *On a cloddy seed-bed greater depth is required*

Fig. 4.—A Plat of the Honduras variety of Rice (G.I., No. 1643) at full maturity.

in order that all seed may be covered. A drill should be used to get a uniform depth and distribution of seed, for these conditions insure an even stand, which is an advantage in controlling weeds. In broadcasting seed there is always danger of getting a very uneven stand, due to difficulties in covering. Poor seeding reveals itself again at harvest when the rice does not ripen uniformly, which always means a loss, whether the field is cut when ripe or when portions of it are immature. This loss may come from the shattering of grain from the mature plants or from the low marketable product caused by small and poorly-formed kernels.

The rate of seeding will vary according to the variety of rice, the vitality of the seed, the character of the seed-bed, and the method of seeding. With the small-grain rices, which, as a rule, tiller heavily, the quantity of seed that should be sown per acre should be less than with the large-grain rices that do not tiller so strongly. Too thin seeding, however, induces excessive tillering, which invariably results in irregular ripening and low-grade rice. The sowing of seed of good vitality in a well-prepared seed-bed will always give better results

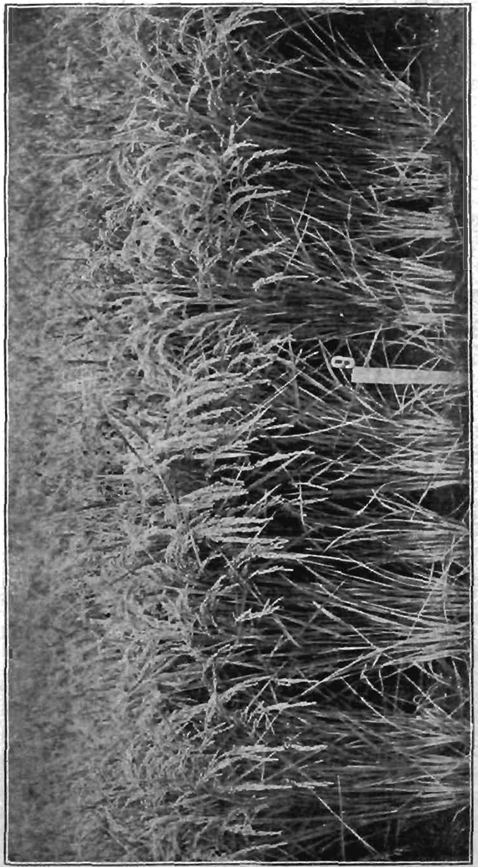


Fig. 5.—A Plat of the Shinriki variety of Rice (C.I., No. 1642), at full maturity. This variety requires a long season and should not be planted later than 15th April in the Sacramento Valley.

than the sowing of seed of low vitality in a poorly-prepared seed-bed. A smaller quantity of seed is used when drilled than when broadcasted.

Rice should be sown late enough to escape the extreme cold weather of spring, but early enough to mature before the autumnal rains. Sowing in April usually will be safe, as the crop will seldom be exposed to low temperatures.

Level tracts of land with sufficient slope for effective drainage, if they possess the required characters of soil and subsoil, are admirably suited for rice. In the use of such lands for this crop the field should be enclosed by strong embankments and so subdivided that each sub-field shall have a surface level enough to hold the irrigation water at a rather uniform depth, and yet with the necessary slope for good drainage. These conditions are obtainable by constructing the field levees on contour lines at distances which, during submergence, will hold the water at a depth of approximately 5 inches on the lower side, and 3 inches on the upper side of each sub-field. These levees should be just high enough to prevent the water from overflowing into the sub-fields below and broad enough to allow all kinds of machinery used in the cultivation of rice to pass over them easily and without damage to them. The planting of the field levees, which is made possible by their construction, will leave no uncultivated strips of land in the field for the growth of weeds, and though the rice upon them may not be equal in every respect to the main crop, the results obtained in the control of weeds alone will justify the practice. Such levees are permanent, and with little money and time can be kept in excellent condition.

The successful cultivation of rice is dependent upon an abundant and always available supply of water. This does not mean, however, that the land upon which the crop is grown must be submerged during the entire season. Under the favorable conditions of a good seed-bed, water need not be applied for germination. However, the soil should never be allowed to dry out. This will require frequent irrigation.

After the plants have tillered well, the land should be submerged for a week to as great a depth as the levees will allow. At the end of this time the water may be lowered in the sub-fields to approximately 1½ inches and kept at this stage until the plants begin to "boot," when the water should be applied again to the maximum depth for a few days (Fig. 3). After most of the heads have appeared, the water should be applied for a third time to its maximum depth and maintained without fluctuation until the heads are well turned down (Fig. 5). At this stage of growth the fields should be rapidly drained.

With effective drainage (Fig. 6) the ground will be dry and firm enough within two weeks to support the weight of the harvesting machinery. Rapid drainage of the fields at this time is imperative if the crop is to be harvested at the least expense in labour and loss of grain. It can be easily obtained through open ditches, varying in depth from 2 to 4 feet, if properly located and kept free of weeds and other obstructions. Even with increased power the self-binder cannot do efficient work on wet ground, and the delay in harvesting on account of a boggy field invariably results in reduced yields from the shattering of the grain. Besides facilitating the field operations

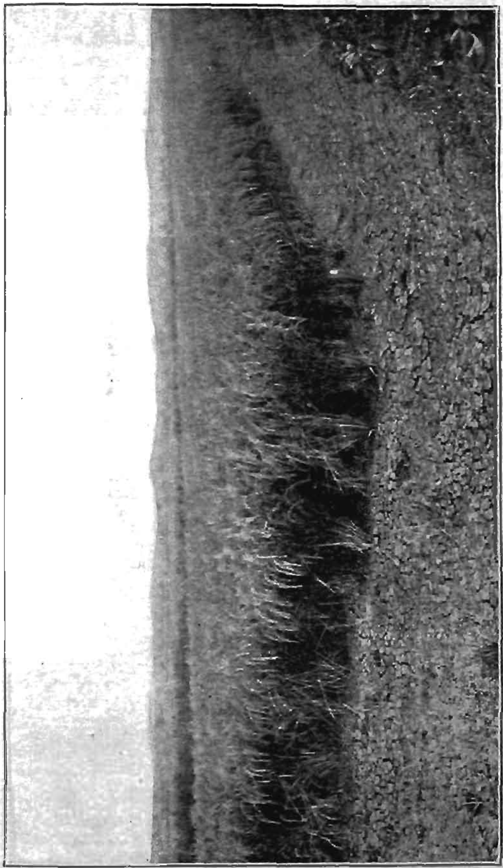


Fig. 6.—A tenth-acre Plat of the Wataribune variety of Rice (S.P.I., No. 1561), drained for harvest. This variety requires a long season and should not be planted later than 15th April in the Sacramento Valley.

at harvest, thorough drainage is needed for other purposes. With a crop that requires water so constantly and abundantly as rice, there is always danger of the soil becoming water-logged unless provisions are made for removing the surplus water. A well-aerated soil is just as essential for rice as for any other crop if maximum yields are to be maintained. To prevent alkali from accumulating in dangerous quantities and for the control of aquatic weeds a good drainage system is a necessity, and makes possible the rotation of crops, which must be practised if the fertility of the soil is to be conserved.

The rice crop is valued not so much for the yield in bushels as for the yield in pounds of head rice, or whole grains, which it will produce when milled. It is therefore important that all parts of the field should mature simultaneously, and that there should be no delay in harvesting, for a lack of uniformity in ripening produces too many chalky grains that do not mill well, and the long exposure of ripe grains to the sun produces cracked kernels that break readily in the process of milling.

The milling quality of rice is further increased by prompt and careful shocking. As soon as the grain is harvested, the sheaves should be put into round shocks. These shocks must be strongly built to withstand the wind, and well capped to protect the grain from rain and sun. During dry weather the process of curing requires at least two weeks. This period is considerably prolonged during rainy weather. Under no circumstances should the grain be thrashed until the kernel is hard and the straw thoroughly dry. After thrashing, the quality of the grain may be seriously affected by exposure to rain and sun. For this reason thrashed rice should be stored at once under a good cover.

Summary.

Clay soil with an impervious subsoil, if it lies in level tracts and can be well drained, is well adapted to rice.

Shallow soils are preferable to deep soils, because less water will be required to submerge them.

For rice there should be an abundant and always available supply of water.

To prepare a good seed-bed on black adobe soil it is better to plough in autumn than in spring.

Sow with a drill.

Plant in April if the land is dry and firm enough to support teams and implements.

Do not allow the soil to bake.

Keep the necessary moisture in the soil by frequent irrigation.

Keep the land submerged from the time the plants have tillered well until the heads turn down.

Provide for thorough drainage.

Build shocks to protect the grain from sun and rain.

Keep the rice in shocks at least ten days before thrashing it.

Conclusions.

The results from a two-year test of 300 varieties of rices on black adobe soil near Biggs, Cal., indicate the possibility of rice culture in

the Sacramento Valley. The successful introduction of this crop is dependent upon an abundant supply of water, which must always be available during the growing season. The soil area adapted to rice in this valley is sufficiently large to produce many times the 55,000,000 pounds of cleaned rice which are consumed each year on the Pacific Coast. How much of this area has sufficient available water for proper irrigation is uncertain, though for a good portion of it there is apparently an abundant supply. Increase in the rice acreage should therefore be made with care.

BEE-KEEPING IN VICTORIA.

(*Continued from page* 371.)

By F. R. Beuhne, Bee Expert.

XIV.—DISEASES OF BEES—*continued.*

A disease of the brood of bees which, while somewhat resembling foul-brood in appearance, but without the characteristic ropiness of the dead larvæ, has for some years attracted the attention of bee-keepers in other countries. That this disease is distinct from foul-brood is proved by the fact that in the study of samples carried out by Dr. G. F. White, of the United States Bureau of Entomology, no micro-organisms were found either culturally or microscopically.

This disease is present in Victoria, and, as it will sometimes entirely disappear or yield to the cutting out of the affected brood, the temporary success of this superficial treatment has, in some cases, caused the adoption of this method for the treatment of foul-brood, for which it was mistaken by bee-keepers.

Even when this disease disappears without treatment, it may reappear the next season. As it has been proved to be infectious, bee-keepers are advised to treat affected colonies in the same way as those suffering from foul-brood; that is, by the removal of all infected material from the hive.

Dr. G. F. White commenced the study of this disease in 1902. In a pamphlet just issued by the United States Department of Agriculture he gives it the name of sacbrood, on account of the sac-like appearance of the dead larvæ, which can be removed from the cell without rupturing their body wall.

Sacbrood.

On page 3 of the pamphlet referred to, Dr. White, concerning the symptoms, says:—

" The strength of a colony in which sacbrood is present is frequently not noticeably diminished. When the brood is badly infested, however, the colony naturally becomes appreciably weakened thereby. The brood dies after the time of capping. The dead larvæ are therefore almost always found extended lengthwise in the cell and lying

with the dorsal side against the lower wall. It is not unusual to find many larvæ dead of this disease in uncapped cells. Such brood, however, had been uncapped by the bees after it died. In this disease the cappings are frequently punctured by the bees. Occasionally a capping has a hole through it, indicating that the capping itself had never been completed. A larva dead of this disease loses its normal colour and assumes at first a slightly yellowish tint. 'Brown' is the most characteristic appearance assumed by the larva during its decay. Various shades are observed. The term 'gray' might sometimes appropriately be used to designate it. The form of the larva dead of this disease changes much less than it does in foul-brood. The body wall is not easily broken, as a rule. On this account often the entire larva can be removed from the cell intact. The content of this sac-like larva is more or less watery. The head end is usually turned markedly upward. The dried larva or scale is easily removed from the lower side wall. There is practically no odour to the brood combs.

"The Infectious Nature and Cause of Sacbrood.

"In the study of samples of this disease received directly from bee-keepers no micro-organisms have been found, either culturally or microscopically, to which the cause of the disease can be attributed. This fact, together with the fact that the disease often disappears without any great loss to the colony, would tend to indicate that the disease is not infectious. The experimental evidence which I have obtained proves, however, that the disease is infectious.

"Experimental Work with Sacbrood.

"Evidence has been obtained by me that sacbrood can be transmitted from diseased to healthy brood. Three healthy colonies were inoculated, each with diseased material from a different locality, and in each of these three experimental colonies the disease was produced. These results indicated at once that sacbrood is an infectious disease. The microscopical and cultural study of the infected and dead brood in these experimental colonies, as in the case of the diseased brood in samples direct from the apiary, failed to show any organism to which the cause of the disease could be attributed.

"This led naturally to a study of the condition to determine whether or not the virus of the disease was so small that it had not been seen. To obtain evidence on this point material containing the virus was filtered using an earthenware filter. The three colonies in which the disease had been produced experimentally furnished the disease material for the experiments. Larvæ, sick and dead, of sacbrood were picked from the combs, crushed, and diluted with sterile water. This suspension was filtered by the use of the Berkefeld filter. From each of the three diseased colonies a separate filtrate was obtained, which was fed in syrup to healthy colonies. Six colonies were thus fed—two with each of the three separate filtrates. As a result of these inoculations sacbrood with typical symptoms of the disease was produced in all of the six colonies thus fed.

"One more experiment will be mentioned at this time. In this the diseased brood used was taken from one of the colonies in which the

disease had been produced by feeding filtrate. Disease material from this colony was filtered as before and fed to two healthy colonies, with the result that sacbrood was produced in each. It might be mentioned here also that other experiments made indicate that the virus is killed by the application of a comparatively small amount of heat.

"In eleven colonies, therefore, sacbrood has been produced experimentally by feeding to healthy colonies the virus of this disease. In eight of the eleven colonies the disease was produced by virus that had passed through the Berkefeld filter. The disease, therefore, which bee-keepers have for a long time recognised as being different from either American or European foul-brood, has now been demonstrated to be an infectious disease that is caused by a filterable virus.

"The conclusion to be drawn from this work, therefore, is that sacbrood is an infectious disease of the brood of bees caused by an infecting agent that is so small, or of such a nature, that it will pass through the pores of a Berkefeld filter.

"The three principal brood diseases, then, are now all known to be infectious. These diseases are—American foul-brood, caused by *Bacillus larvæ;* European foul-brood, caused by *Bacillus pluton;* and sacbrood, caused by a filterable virus."

Diseases of Adult Bees.

While the causes of brood diseases of bees are well known, the state of our present knowledge of the diseases of adult bees is much less satisfactory. The latter are three in number—Paralysis, dysentery, and disappearing trouble.

Bee Paralysis.

This is a disease of the adult bees, the cause of which is still unknown. The first indication is the presence in the colony of a few shiny, emaciated looking bees; these are still capable of flight, and some will go foraging, but they often fail to return, remaining on flowers and other objects and die. Later on numbers of bees with abnormally inflated abdomens will be noticed in the hive. They may be noticed about the hive entrance, their wings and legs extended sideways, giving them a sprawling appearance. Their movements are jerky, and their wings quiver at intervals. When a hive is opened some of the bees so affected will, after a few minutes, come on top of the frames. When smoke is blown amongst the bees they remain on top, while the healthy ones run down between the combs. After paralysis has been present in a colony for a considerable time even the newly-hatched bees may become infected. They crawl from the hive, fall over on their side or back, just move their legs now and again, and do not die till many hours later. In the case of these young bees, there is no swelling of the abdomen and no quivering of the wings.

Paralysis in Victoria is more prevalent north of the Dividing Range than in the coastal country, but whether this is due to climatic influences or to variations in the food supplies is not known. Many remedies have been advocated, such as sprinkling the bees with sulphur flour, spraying them with brine, or feeding medicated syrup, and although the disease is often checked for a time, no cure is effected. When using sulphur the brood should be removed, as otherwise the sulphur will kill

all the unsealed brood and eggs. The brood removed may be given to any other colony without risk of infecting it, provided care is taken to shift none of the adult bees with the combs. There is no doubt that some strains of bees are predisposed to paralysis, and the only treatment known to be at all effective is to kill and replace the queen of every hive showing the first symptoms of the disease, and thus gradually eliminate it. If the new queen is of the same strain, or of another one equally predisposed, no cure will result. In obtaining queens from elsewhere for the purpose of re-queening colonies showing paralysis it will be better to get them from an apiary from which the disease has been eliminated than from one in which it has never made its appearance, because in the former the queens would be from stock which proved immune in contact with the disease, while in the latter there has been no such test.

It is of the utmost importance that on no account should queens be raised or kept from stocks which show signs of paralysis, no matter how desirable they may be in all other respects; further, the queens of all affected hives should be replaced as soon as possible. to prevent the raising of predisposed drones, which by mating with the young queens would perpetuate the weakness in the apiary.

Dysentery.

The symptoms of dysentery of bees are the soiling of the hive entrance and the immediate surroundings with the watery excrement of the bees. This is brownish-yellow, and has a disagreeable smell when dysentery is present, while under normal conditions it is darker in colour, and drier, and is voided at a greater distance from the hive. This spotting of the hives and surroundings usually occurs in spring, when the bees have been prevented from taking a cleansing flight by a long spell of cold weather. When bees winter on thin, watery honey they have to consume greater quantities to produce the required animal heat than when their winter food is of proper density. Bees in a healthy state do not void inside the hive, but when, owing to inclement weather, they are unable to fly, there is, on account of the consumption of a large amount of diluted food, such an accumulation of waste in their bodies that they are forced to discharge it inside the hive, soiling each other and the combs. Before this condition is reached the bees are so surcharged with accumulated waste that they are unable to consume sufficient honey to maintain the animal heat necessary, and many perish. The cause, as already indicated, is the consumption of watery honey during cold weather. Honey may be too thin for winter food. because it was gathered so late in the season that the bees were not able to evaporate it to its proper density on account of low temperature and humidity of the atmosphere, or it may have absorbed water from the air because it was not sealed and not covered by the cluster of bees.

With the approach of warm weather, colonies suffering from this type of dysentery will recover, provided sufficient bees are left. As a preventive, I would recommend removing all surplus combs and boxes from the hives at the approach of cold weather, and confining the bees to just the number of combs they can cover. If this is done the bees will be prevented from storing outside the cluster honey which they

may gather on odd fine days, also the loss by radiation of the heat generated by the bees will be reduced to a minimum, thus economizing in the consumption of stores and avoiding an excessive accumulation of waste matter in the bodies of the bees.

INFECTIOUS DYSENTERY.

This is a disease which has caused enormous losses of bees in Great Britain and Germany. Dr. Zander, of Erlangen, Bavaria, first drew

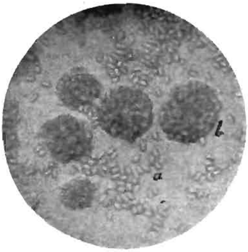


Fig. 1.

Fig. 2.

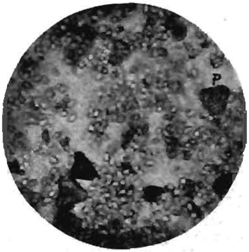


Fig. 3.

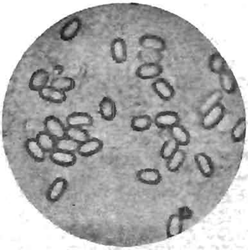


Fig. 4.

[Illustrations reproduced from *Handbuch der Biene*, Vol. II., by Prof. Dr. Enoch Zander:—Figs. 1, 2, Nosema spores, (*a*) single spores, (*b*) intestinal cells filled with spores × 400. Fig. 3, Nosema spores (Australian) (P.), Eucalyptus pollen × 400. Fig. 4, Nosema spores × 1,000.]

attention to it at a meeting of German bee-keepers held at Weissenfels in August 1909. The disease is a malignant type of dysentery, caused by the invasion of the digestive tract of the bee by an animal parasite of oval shape, which multiplies with great rapidity, and by the destruction of the cell wall of the chyle stomach causes the death of the bee. Dr. Zander discovered this organism during 1907 in the intestines of bees suffering from malignant dysentery, and named it *Nosema apis*.

This parasite, when in the spore (dormant) stage, is oval in shape, and measures about 1-200 mm. in length by 1-500 mm. in breadth (Figs. 1, 2, 3, 4). Infection is spread by means of the spores voided with the excreta of diseased bees coming into contact with the bees' food or drinking water. The visible symptoms are described by Dr. Zander as follows:—"Sudden mortality of large numbers of bees within or outside the hive. The bees become restless, separate from the cluster, fall off the combs, crawl excitedly out at the entrance, and, unable to fly, collect on blades of grass and other objects, and sooner or later die, the abdomen being more or less inflated."

In May, 1912, the British Board of Agriculture published a report on the bee mortality, known in Great Britain as the Isle of Wight Bee Disease, giving the results of the investigations of Dr. Graham-Smith, H. B. Fantham, Annie Porter, G. W. Bullamore, and Dr. W. Malden In this report the name of *microsporidiosis* is given to the Isle of Wight Disease and *Nosema apis* as its cause. In regard to symptoms, the authors state—Inability of some of the diseased bees to fly, the presence of numerous bees crawling on the ground in front of the hives, and the gradual dwindling of stocks are common, but many other symptoms have been recorded, and no one symptom is characteristic of the disease. The only essential feature is the death of large numbers of bees, and often of the whole stock, especially during wet and cold periods of the year or during the winter months.

The presence of the *Nosema apis* parasite in Australia was first discovered in October, 1909, and made public in the *Journal of Agriculture*, January, 1910. It was then generally assumed that the heavy losses of bees occurring at intervals in certain districts of Victoria and some other States were caused by *Nosema apis*.

Since then the microscopical examination of bees from all over Victoria, the adjoining States, and Tasmania have shown that *Nosema apis* is present in almost every apiary, and equally numerous in the intestines of bees from localities where no losses have ever occurred Out of 84 lots of 20 bees, each obtained from different apiaries, and examined by Mr. W. Laidlaw, B.Sc., Biologist, Department of Agriculture, only two apiaries were proved free from the parasite in the 20 bees examined. If, therefore, *Nosema apis* is a factor in what is known as the disappearing trouble, it does not appear to be the only one, since in many localities bees are exceedingly prosperous, notwithstanding the presence of the parasite in their organism.

These micro-organisms were first noticed by Dönhoff and Leuckart in 1857, but regarded as vegetable parasites, *protozoa* being at that time unknown. Bees were then not kept in such large numbers of colonies in one spot, and the frame hive being then not known, new combs had to be built by the bees after every robbing of the hives. With the advent of the frame hive system bees began to be kept in apiaries, numbering hundreds of colonies, the old combs were used for many years, and the swarms hived and placed close to the old hives. Whenever large numbers of animals are kept for any length of time on the same spot diseases break out, unless certain precautions are taken. In the case of bees in a state of nature, their nest is usually some distance from the ground; all refuse and dead bees thrown out, as well as the excreta, fall to the ground out of harm's way. When a swarm

issues, it establishes a new home some considerable distance away in clean surroundings, where it builds new combs. In the case of a modern apiary, large numbers of colonies are kept on a comparatively small space; the hives are on the ground, which in time becomes contaminated with excrement, dead bees, and refuse from the hives. The bees are compelled to breed in the same combs year after year. The causation *of disease by micro-organisms depends upon the amount of resistance* which the invaded host offers and the degree of infection which takes place. A vigorous, well-nourished animal will overcome a degree of infection to which a constitutionally weak one, or an ill-fed one, would succumb. The modern apiarist, by keeping large numbers of colonies on a limited space for years, and using the same brood-combs continuously, has thereby raised the degree of infection to which the bees are subjected, while by breeding his queens for prolificness and colour he has weakened the race and reduced its vigour and resistance to disease.

To counteract these results of the present day system of bee-keeping remedies may be found in the periodical shifting of apiaries on to new ground (the further from the old site, the better), the replacing of the brood-combs with new ones at intervals of a few years, and the restoration of the bees to their origiual vigour, by breeding all queens from stocks giving the highest yields of honey (an indication of longevity) and not from colonies with an abnormal amount of brood only.

(To be continued.)

TAGASASTE.

(*Cytisus proliferus, Linn. f.*—Commonly called Tree Lucerne.)

ECONOMIC AND ORNAMENTAL PROPERTIES.

By J. W. Audas, F.L.S., National Herbarium, Melbourne.

Tagasaste has been so long known as "tree lucerne" that it is becoming difficult to challenge its claim to the name. It is not the plant to which the name "tree lucerne" properly applies, as the more rightful owner of the title is another member of the *Leguminosæ*, viz., *Medicago arborea*, a native of Italy, where it grows to a height of 6 feet, and is tree-like as compared with ordinary lucerne (*Medicago sativa*), but differs from it in appearance somewhat. The origin of the misappellation is probably due to the striking similarity of the foliage of "Tagasaste" with that of ordinary lucerne. Tagasaste is a shrub indigenous to the Canary and Madeira Islands, the home of so many of the Cytisus or Laburnums. Although introduced to Australia fully 30 years ago, this plant has never received the cultivation it merits, and it is to be regretted that its many good qualities have been so long overlooked. Throughout all the plain country of the Mallee districts of our State, where it should be especially valuable, it is practically unknown, and only of late years has it been grown near Melbourne.

Although impossible in the space of a small article to deal with all its uses, I wish, for the benefit of bee and poultry keepers, to bring a few of its more valuable features under notice.

USES.

If grown at apiaries as hedges or shrubs it is a valuable acquisition in an ornamental sense, but more particularly on account of the profitable quality of its very melliferous white flowers, which are borne in profusion at a time when there is little else blooming; this period being in Victoria from about June until August. Poultry farmers are beginning to perceive the value of Tagasaste, and those who have initiated its cultivation are enthusiastic in praise of it. If grown in the fowl runs it provides excellent shelter, and the tender leaves are relished as the necessary "greens," while when allowed to grow up into young shrubs or trees, and no longer within reach of the birds, it flowers, and in due course the seeds falling from the bursting pods, supply another valuable food. As a fodder plant it has qualities which place it far above many better known ones, being green all the year, and is easily cultivated. It remains uninjured by frost and withstands drought well, and should therefore prove a means whereby Mallee farmers could raise the stock-carrying capacity of their land to equal that of districts with a more favorable rainfall. But perhaps the supreme utility of Tagasaste will be found in its uses as shelter belts or wind breaks, being superior in certain localities to the sugar gum and pepper tree, which are so favored for that purpose, for, unlike these trees, whose roots spread near the surface and thus render a considerable area of land useless, those of the Tagasaste penetrate deep into the subsoil, so that grass and smaller plants grow uninjured beneath it. This deep rooting quality renders it useful in market gardens, for when sown between rows the seed will spring up quickly and protect tender plants from wind and frost

CULTIVATION.

The manner of cultivation must be varied according to the purpose for which it is being grown. If intended for fodder it should be sown thickly and frequently cut to keep the foliage tender, for it will be readily understood that horses and cattle, which relish it exceedingly in this way, soon show a dislike and reject it, if it is allowed to grow harsh and woody. Every cutting renders the crop more valuable, and it will yield more fodder to the area under cultivation than almost any other plant, supplying a diet on which horses will thrive and fatten, and which, when mixed with grass or straw, is equal to the best wheaten hay. The germination of the seeds may be hastened by soaking overnight in boiling water, but this treatment is not essential, for being very hardy, they will spring up quickly on almost any loose soil, and should be thinned out in distances varying with the ultimate size of trees. I should suggest for hedges about 4 or 5 feet, and for shelter belts 8 to 10 feet. The growth of a year gives the trees sufficient height to protect crops and small fruits, or vineyards, while three years should furnish a growth of 15 feet and upwards, and the trees will be sufficiently large to form an excellent wind break for large orchards. Tagasaste finds most congenial conditions in a sandy soil and warm climate, and can only be said to have one weak point in its climate-resisting armory, that is, its aversion to damp; therefore, land in preparation for planting should be well drained, and it is not advisable to attempt its cultivation in low-lying or swampy areas.

REVIEW OF THE BUTTER SEASON IN VICTORIA, 1912-13.

By P. J. Carroll, Senior Inspector, Dairy Produce.

The season about to close is not remarkable for any new developments in the export trade in butter.

The total butter exported from Victoria to all destinations from 1st July, 1912, amounts to 15,226 tons, having an approximate C.I.F. value of £1,690,086. This total includes 698 tons of butter from Tasmania, and 214 tons from other States, so that the butter of Victorian production shipped was only 14,314 tons, valued at £1,588,854. This compares unfavorably with 20,234 tons of Victorian butter, worth £2,529,250, exported last season, and 25,154 tons for 1910-11 worth £2,641,170.

This falling-off in production can only be attributed to the climatic conditions prevailing throughout the State, and to the fact that not sufficient provision is made for the stock during these dry periods. It would not be difficult, indeed, to increase our average production from 25 to 30 per cent. from the same number of cows if an abundance of fodder were made available at all times. It has come under my own notice on more than one occasion where cows have practically doubled their yields in one week when removed to better pastures. Let us hope, however, with the spread of closer settlement and the development that is taking place in the irrigation districts, that better methods will prevail. Under a proper system of irrigation and rotation it is possible to have an abundance of green fodder the whole year round.

In addition, whilst dealing with the question of increased production, it might be opportune to here mention that according to recent reports and statements in the press relating to the condition and prospects of the London market, dairy-farmers will be obliged to accept lower values for their produce in the future.

Co-incident with this reduction in value must come a corresponding reduction in the cost of production, if the business of dairying is to be carried on profitably. Dairy-farming, with all its attendant hardships, is not the gold-mine it is asserted to be by those outside the fence. Under the best of conditions, it means long hours and close attention to work. If the product of that labour is to be sold on a lower basis, then the dairyman must adopt different methods. The first and most important step, to my mind, is the growing and conservation of fodders, so that, to a reasonable extent at least, they will be independent of extremes in the climate.

The present prospects offer one of the best opportunities for putting this doctrine into practice. In no instance, within my recollection, have the dairymen and farmers generally had such excellent prospects for a bountiful season. The rainfall has been ample without being excessive, the almost entire absence of frosts and the genial weather has promoted the rapid growth of crops and pastures, and left the land in a suitable condition for preparation and cultivation

*Paper read before the Twentieth Conference of Australasian Butter and Cheese Factories Managers' Association, May, 1913.

for summer crops. I trust that factory managers will interest themselves in this matter, and impress upon their suppliers the wisdom of taking advantage of the season and planting additional reserves of fodder.

The next step of importance is the culling and improvement of herds. It is well known that a cow returning 300 gallons of milk per annum will consume as much food and require as much attention as one producing 600 gallons, with the difference that the latter will return a profit over and above the cost of labour and food, whilst the former fails to reach the limit of cost, and is therefore loafing on the dairyman. Under present conditions, the dairy-farmers cannot afford to keep these cows at a loss, and should endeavour to eliminate the loafers from their herds at the earliest opportunity.

Prices.

The highest average price received for butter during the past season on the London market was 117s. 1d. per cwt.

The average price of all butters, according to the certified copies of weekly official reports issued by the Home and Foreign Produce Exchange Ltd., is 111s. 9d. per cwt., or a discrepancy of 5s. 4d. per cwt. between the highest average price realized by any one factory and the average of the whole of the State. This discrepancy in price, when applied to the whole of the exports for the season, amounts to the sum of £70,189. It is needless for me to comment on this condition of affairs; the facts speak for themselves, and the remedy is obvious. Another disquieting feature in connexion with the question of prices for the past year is the fact that the range of prices between that realized for Danish, New Zealand, and Victorian butters has widened considerably, as shown herewith.

During the season 1911-12 the average prices for Victorian butter were 10s. below Danish and 3s. below New Zealand, whilst for the season 1912-13, Victoria was 18s. 2d. behind Danish and 5s. 7d. below New Zealand. It is evident from this that the popularity of Victorian butter is rapidly declining, or the manner in which the butter is placed before the consumers is not such as to enable us to obtain full value for our produce. This decline in value is out of all proportion to the slight falling-off shown in quality which I will deal with further on.

Grading.

Early in the present export season the compulsory grading and grade branding of butter was considered by the High Court to be *ultra vires*. Notwithstanding this fact, however, a check has been kept upon the quality of all butters exported through the Government Cool Stores, particulars of which will be referred to later.

Although grade-stamping was practically suspended at the time of the decision above referred to, many manufacturers and exporters availed themselves of the voluntary provisions of the Act, with the result that for the season up to date, 47.6 per cent., or nearly half of the whole of the butter sent forward for export, was shipped, bearing the Government grade stamp on the boxes. Up to the present, not one complaint regarding grading has been received from the London

end, and I can only conclude that the verdict of the graders met with the approval of the purchasers of the butter.

I trust that when the subject of grading is under consideration again that provision will be made for the issue of advices regarding quality to factories for each consignment of butter forwarded for export. Whatever difference of opinion exists amongst manufacturers and exporters regarding the merits of grade stamping, I think there is only one opinion on the question of grading, from an educational point of view, and I would strongly urge the Government to extend its efforts in this direction by combining, with the system of grading, practical instruction in the factories the same as is done in New Zealand.

That there is need for further improvement in our methods of manufacture is evident from the nature of the awards and the remarks of the graders.

Quality.

I regret to have to report a slight falling-off in the average quality of our export butter as compared with the previous season.

The following shows the relative percentage of the different grades for the past two seasons:—

	1911–12.	1912–13.	
Superfine	16·74	.. 14·39	– 2·35
1st Grade	58·43	.. 60·09	1·66
2nd Grade	22·78	.. 22·97	·19
3rd Grade	1·87	.. 2·51	·64
Pastry	0·18	.. 0·04	— ·12

Average grade, 90.79 as against 91.07 for the preceding season.

Although the difference is not great, it is unfortunately in the wrong direction, and it behoves us to put forth all our best efforts to not only maintain our present standard, but to improve upon it. I cannot do better than to quote here in support of this contention the remarks of Mr. James McKenzie, chairman of the Gippsland and Northern Co-operative Selling Coy., as published in the *Gippsland Standard* on Friday, 28th March, 1913, when presiding at a shareholders' meeting of the Yarram Butter Factory. Mr. McKenzie had just returned from an extended trip to the Old Country, during which time he stated that he had made close inquiry into the conditions of the London butter market. Amongst other things he said, "the matter of most moment to us is to set some comprehensive scheme in motion to improve the quality of our butter, and prevent the manufacture of anything but the best." "Margarine will never capture or displace the legitimate trade for our choicest butters, and it is only that grade which will have any chance of holding its place on the London markets," and further, in the Melbourne *Herald*, of 29th January, 1913, the same gentleman writes: "I did hint at the means of minimizing that competition. Make the very best high quality butter and send such only to Great Britain, then the competition is minimized."

This is plain language, and unmistakable in its meaning. I can commend it to both managers and dairymen alike. It is also a complete answer to the statements made that poor quality butter improves

in transit, and not infrequently realizes as good prices as butter of better quality on the London market.

The question of the necessity for improvement in quality has been dealt with by the press and the people interested in the trade in London. The experience of the past season has more than emphasized the truth of these statements and comments, and I think it is now time that those directly interested in the production of butter should take a hand in the matter themselves. It is a well-known fact that herds of cows do not produce cream that will make second or third-class butter at time of production. Deterioration takes place between that stage and the time the manufactured product is placed upon the market. If no other means are at hand, I think it would be perfectly within the rights of the State and the Commonwealth to make a law prohibiting the export of butter below a certain standard, and thus protect and conserve the reputation of an industry which was at one stage of our history the salvation of the State, and has been ever since, and will continue to be, if conducted on right lines, one of our staple industries. No other industry offers so many opportunities for placing people on the land and insuring them a livelihood; in fact, there is no industry in this State which lends itself so readily to the increase of our rural population as that of dairying. Are we to allow its very existence to be threatened, its usefulness as a factor in opening up and developing this country to be destroyed, because we fail to realize that, in order to maintain our hold upon the consumers of England, we require to produce an article that would not have as a competitor a cheap substitute such as margarine, but a butter the quality of which will do credit to Victoria?

Composition.

Butter-Fat.—As only two consignments, representing 58 cases, were detained for deficiency in fat, it is reasonable to assume that the average was well above the prescribed standard.

Moisture.—The average moisture contents of the 2,207 samples of butter analyzed this season were 13.91 per cent., or exactly the same percentage as for the season 1911-12. The averages for the different districts are as follows:—Western, 14.23; Gippsland, 13.97; N. & N.E., 13.91; City, 13.88.

It will be remembered that on 16th November, 1912, the Hon. the Minister for Customs issued a Proclamation altering the standard for moisture from 15 to 16 per cent.

The average moisture contents of the samples analyzed up to that date were 13.76 per cent., and since the date of that proclamation 14.02 per cent. There were 25 consignments found to be above the limit in moisture when the standard was at 16 per cent., and 13 consignments since the alteration, or a total of 38 infringements under this heading for the season, as compared with 131 for the previous one. This shows a satisfactory improvement in manufacture in the direction under notice.

Boric Acid.—Eight consignments, representing 411 boxes, were detained on account of excess boric acid, as compared with eleven consignments for the previous season.

WEIGHTS.

I regret to say that the same satisfactory condition of affairs does not exist as regards weights. Under this heading contraventions occurred to the extent of no less than 167 consignments of butter being held up for either short or bare weight or both, as compared with 95 last season, thus showing an increase of 75 per cent. in the number of offences.

There is evidently a growing laxity regarding weights in some of our butter factories, and the managers should give attention to the matter without delay. Carelessness in the actual weighing or in the attention given to the scales is mainly responsible for this trouble, and whilst it is perhaps not a vital point in connexion with the quality of our butter, it is significant of a want of interest and attention on the part of those responsible that may make its appearance, in other phases of manufacture, with much more serious consequences. Apart from the amount of the penalties exacted by the Customs Department for those offences, and the expense incurred in weighing the whole consignment, and the purchase of butter to make up the weight, there is another and more serious aspect, namely, the effect on the quality of the butter. In warm weather, this butter has to be removed from the cool chamber for weighing, every box of the consignment has to be opened and tipped out on to the scales. Those that are short have to be made up to the correct weight, the butter used is in most cases not from the same factory, in all probability it is not of the same quality, and invariably of different colour, and finally, this work is done by persons inexperienced in butter factory work. Managers can imagine the effect such treatment and exposure will have on the appearance and neatness of the parcel, and when these patched-up boxes are opened up for examination, one is presented with a daub of butter on the top of each box of a deeper or lighter hue than the remainder of the contents. I feel sure that it is only necessary to bring the evils of this fault under notice to have immediate attention in future.

GENERAL DEFECTS.

During the season under review, there were 150 exporting factories, which submitted for examination close on 10,000 consignments of butter: 50,000 boxes, representing 10 per cent. of the number of boxes presented, were examined, with the following result:—

Flavour.—3,416 consignments were penalized for staleness in flavour, 435 for metallic flavour, 362 for heated flavour, or a total of 4,213 consignments, representing nearly one-half of the whole, for defects in flavour.

Manufacture.—One thousand and seventy-three consignments were penalized for greasiness in texture, 606 for mottle, 522 for free moisture, 151 for milky or cloudy moisture, or a total of 2,352 consignments which were found to be suffering from defects in manufacture.

Of those referred to under the heading of "Flavour," managers can hardly be held wholly responsible, but the 2,352 consignments for which points were deducted for faults in manufacture must be placed at the doors of factory managers.

The lack of efficient refrigeration, or proper attention to temperatures, is chiefly responsible for these manufacturing defects, and I

would suggest an earnest effort on the part of managers to remove the cause of these complaints without delay.

Moulds.—Twenty consignments were found to be more or less badly affected with mould.

In many cases, the butter was transferred into other boxes and re-papered before shipment, on the recommendation of the officers of the Department. Many reasons are advanced as to the cause of moulds. I will not here enter into the various causes, but would suggest that proper steps be taken by our factories to prevent an outbreak of this infection. Mould cannot grow on an unseasoned box any more than it can on a seasoned one if the spores are not present. No factories are immune from attack, so that it is only by preventive measures that the trouble can be averted. Empty boxes and paper should be kept out of the way of infection, admit as much light as possible into your storerooms, and keep the factory free from moulds, and this trouble will cease.

It is only by close and constant contact with the produce from the different factories that one can realize the extent to which shortcomings in the process of manufacture are evident.

Directors and proprietors of butter factories should endeavour to permit their managers to visit the Cool Stores at intervals during the export season, so that they may note the faults in their product, and make comparisons with other factories' butters. By doing this, they would keep in close touch with the work of grading, and this would materially assist them in their duties at the factories.

There are many little points that may appear insignificant when written in a report, but when seen by the manager of the factory, would be regarded as important enough to warrant a change.

Shortcomings.

For the information of managers of butter factories I herewith submit a number of details, which I trust will have attention.

Advices.—Advice notes not infrequently reach the office after the butter is graded: in that case we have no information to guide us in selecting the churn marks, and in the various little details relating to the proper examination of the butter. Many of these advices are incomplete, not containing churn marks in a number of cases, or stating whether the butter is salted or unsalted, and if for export.

Churn Marks.—A very large proportion of the churn marks are indistinct, only a few of the consignments are marked on both ends, and some of the marks are entirely too small.

Boxes.—A small proportion of consignments arrive in a soiled condition, occasionally when boxes are turned out they are found to contain dust and light shavings, and soiled paper as a consequence. Some of the wire-bound boxes are badly closed, the ends of the wires projecting, thus causing injury to the men's hands, and damaged clothing. In other cases there are too many nails in the lids, and the nails are usually too long.

Paper.—Quite a number of boxes were found with mouldy paper, others factory stained, and some fly stained.

Finish.—Very few factories now make a neat and attractive finish. I think managers are becoming more indifferent as regards the

appearance of their butters, or it may be that the finishing rollers are getting dull and blunt, and this fact may have escaped the notice of the manager. I would strongly advise that more attention be given to the finish and neatness of the boxes.

Rivalry Wanted.

Agricultural Shows.—There is another matter that I would like to bring under notice, and that is the question of exhibiting at shows, more particularly from my point of view the classes for Colonial butter at the British Dairy Farmers' Association, who are good enough to provide classes expressly for Colonial exhibitors. Appreciation should therefore be shown by being suitably represented both as regards quantity and quality. It must be remembered that England is the centre and hub of this market, and any efforts by us that are put forward to make that exhibition a popular and successful one must materially assist in advertising our produce.

Other States of the Commonwealth are now turning their attention towards securing these honours, and, in fact, have been successful during the past two or three years in snatching from Victoria the pride of position which she held for years.

It was my privilege to be selected to judge the butter exhibits at the recent Sydney Royal Agricultural Society's Show, and my surprise can be imagined on arriving there, to find myself confronted with an array of butter, consisting of 101 separate exhibits, comprising 155 boxes. On comparing this with the number of exhibits at the last Melbourne Royal Show, which consisted of 23 exhibits all told, I was at a loss to understand the reason. I find the value of prize money is as good in Melbourne as in Sydney, and the entrance fees are lower. Should there be any objections to competing amongst Victorian exhibitors, I feel sure the Council of the Royal Society of Melbourne will endeavour to remove it on being made acquainted with the fact. At the Sydney Royal Show, Queensland and Tasmania were represented by exhibits, but Victoria was absent. I was twitted with this fact by New South Wales managers.

I had some valuable discussions with many of the exhibitors, and was pleased to note a tone of enthusiasm and rivalry in regard to their exhibits. That an exhibition of this sort has its educational side is fully acknowledged by the New South Wales managers, and I understand it is their intention to combine with their Managers' Conference, which is to be held some time in June next, an extensive butter competition.

I think this is a matter deserving of consideration, and I trust that the result will be such that when the cable comes to hand notifying the successful exhibitors at the next Islington Show, that Victoria will not be relegated to the background, and that officers of the Department will not be called upon to invent some ridiculous and feeble excuse to account for the inferior positions occupied by our factories on the prize lists of that exhibition.

I feel that there are many points of importance that have been omitted in this paper, and I trust that inquirers will not be backward in seeking fuller information on these various matters, and I will endeavour, as far as lies in my power, to supply the information.

CITRUS CULTURE IN VICTORIA.

(*Continued from page* 404.)

PART V.—THE LEMON.

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

Lemons.

A fruiting branch of the lemon is shown at C, Plate 28. The fruit is borne on the terminals, axils of the leaves, or any bud brought into activity on the tree. *D* shows the lemon leaf. *E* the petiole. *F* the articulation. Lemon trees require guiding up to the age of three years after planting. They should then be pruned to form a tree more open in the centre than the orange. They can be pruned to the semi-open centre, as shown at Plate 28*a*, where the cuts are indicated by

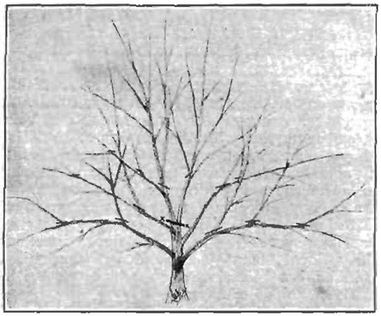


Plate 28a.—Method of Pruning.

the lines ——, or they may be pruned to the direct open centre, as shown by the lines —— and x ——x. If adopting the latter system, which is shown in Plate 28*b*, four well-grown leaders should be selected, equally spaced around the tree, and the strong central growth removed; also any uprights. These selected leaders should be horizontalized as much as possible, and this will have the effect of producing vertical growths. From each of these verticals two should be selected, situated as near the centre of the tree as possible (well spaced), on each of the four leaders, and be allowed to grow for two years, the other growths being either subdued or removed. At the end of two years, or when a strong growth has been made, the vertical strong growth should be removed, by cutting back to a strong lateral, one having an inclination to the right, and the other an inclination to the left of the branch on which they are growing. From these horizontals other verticals will be produced; one should be selected on

each right and left horizontal, and allowed to remain for two years, and at the end of that time, or when a sufficiently strong growth has been made, these verticals should be shortened back to a strong horizontal lateral, having a direction the same as the leaders selected

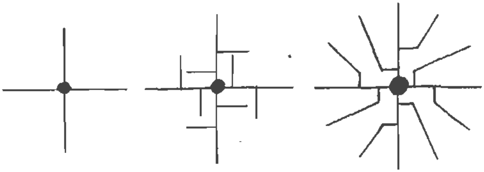


Plate 28B.—Method of Pruning.

at three years of age. The tree will now be seven years of age, and should be about 8 feet high, open in the centre, and clothed all over with fruiting wood accessible in every part, and have a thoroughly symmetrical frame, consisting of twelve leaders, the right and left

Plate 29.—Lemon tree pruned to the open centre, White Hills, Bendigo.

inclined horizontals having been shortened back. The tree will be built up of strong wood, branched and arranged at different angles. When the tree is in shape, strong central upright growths, which will have a tendency to crowd the centre, should be removed, and should any further addition to height or new leaders be required, it is easily

brought about by allowing well-placed verticals to remain, and be treated the same as when the tree was being formed.

Another method of keeping the open centre is by pruning to form sturdy branches, throwing them to the horizontal at intervals by removing a vertical leader, where a strong horizontal grows from it, as shown, Plate 28*a*. A vertical growth results again from the horizontal, and this, in turn, is treated similarly until the tree is of sufficient height. Lemons will stand hard pruning, and open centre arrangement, but care and attention is required to keep the tree relieved of superfluous upright central growths. Allow only weak

Plate 30.—Dome-shaped Lemon Tree unpruned from time of planting.

verticals, or horizontally-placed laterals, to fill in for the supply of fruit. This type of tree produces an even class of fruit, almost free from culls. Plate 29 represents the type of tree, diameter 14 feet, height 9 feet. The fruiting surface of this tree is considerable, as it bears right through from the centre to the outside leafage, and is the type of tree to be aimed at. Plate 30 shows the lemon tree too frequently seen. The tree has been left unpruned throughout its career, and has produced spindly wood of vertical character. The tree is devoid of fruit in the centre, and along the weak verticals. Sap

growths, or robber shoots, have been allowed to form, and remain at will, and the tree generally has led a wild, extravagant career. The quantity of culls from a tree of this description is very great. The fruit is uneven in size, and generally scratched and injured by the effect of wind lashing the weak spindly growths. Plate 31 shows the framework of such a tree. A strong central robber growth is marked at ——, and other vertical robber growths at ——; the tree is dense centred, and fruits practically on the outside surface foot only. Plate 32 shows the robber growths removed, and the tree pruned to semi-open centre, and Plate 33 shows the tree pruned to more direct

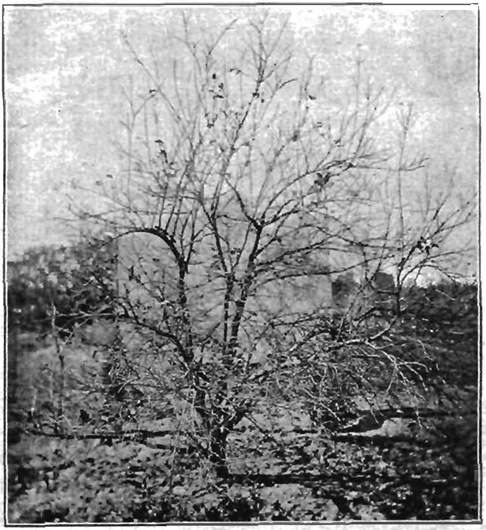


Plate 31.—Framework of unpruned Lemon Tree ten years old.

open centre on the same system as Plate 29. In Plates 32, 33, there has been no attempt to prune to show lateral arrangement, only to show the open centre ——.

The orchard must be made profitable, consequently, pruning should be thoroughly carried out. A tree 20 feet wide and 12 feet high is more profitable than a tree 12 feet wide and 20 feet high. Step-ladders are not a necessity in a properly-trained lemon grove. The grower should always be master of the tree, therefore, the tree should be always under control. The flow of sap should be led and distributed

equally all over the tree. The branches should be covered with elaborated growth from their base to their extremities, and held in

Plate 32.—Lemon Tree pruned to show semi-open centre and removal of sap growth.

absolute control. The extremities of the highest branch should be within reach from the ground. Upright growths make only for wood,

Plate 33.—Lemon Tree pruned to more direct open centre.

and on a vertical shoot the elaboration of sap is greatest at the top, while there is extensive sap elaboration all along a horizontal growth,

and as there is no fruitfulness without this elaboration, a horizontal form must be aimed at. Angles and turns in the branches, made up of wood of different ages, prevent rushes of sap, and force small growth of a fruiting character. Branches should be constructed so that they can support the weight of foliage and fruit without propping. If there is strength at the base, and the growth equally distributed, there will be little necessity for props. Upright limbs exhaust the vitality of the tree; bend them down, and they will produce fruit. Build for the horizontal, and keep to the horizontal, and the lemon will repay you. In orange and lemon pruning remember the tree will be prolific just in the same ratio as you care and attend to it. Study the habits of the tree, and you will become its master.

(*To be continued.*)

COMPETITION IN CEREALS.

The number of plants developed from a bushel of wheat is never equal to the number of grains in a bushel. With good seed nearly the whole may germinate, but subsequently a number will die off owing to competition and other causes. A suggestive investigation bearing on this subject is reported from the University of Nebraska (*Sta. Bul.* 127). Wheat and oats were employed. Seeds were planted at ¼, ½, 1, 1½, and 2 inches in rows to find how many plants survived competition. With the thinnest planting 75 per cent. survived, and with the thickest 56. Next, plump and poorly-developed seeds were alternated in the same row, and of the former 72 and of the latter 62 per cent. attained to maturity. With plump seeds all in one row 65 per cent. survived, and with a row of poorly-developed seeds 60 per cent survived. Two points of direct practical interest emerge from those tests. Pure strains of seed are desirable, because the variety which when sown alone is the best yielder may be dominated by a less productive type in a mixed sowing. The other point raises the value of thick sowing as a natural method of eliminating weak plants from a variety. Plants may die from other causes than competition, but competition is a powerful means of separating the weaklings. It is suggested that thick seeding may do more to improve the variety than seed dressing and grading. This may be open to question, but the line of argument is suggestive. In England it is usual to drill wheat at the rate of 2 to 3 bushels per acre, and here elimination of weakly plants by competition must be great, leading to a strengthening of the type. In Victoria, owing to climatic conditions, it would usually be disastrous to seed at the English rate; and it may be owing to this necessity for thin seeding that some of our best Australian wheats show a strong tendency to degenerate under continued cropping.

THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STANDPOINT.

PART IX.—OVER-SEA TRADE—DISTRIBUTION AND MARKETING—*continued.*

(*Continued from page 397.*)

By E. Mecking, Senior Fruit Inspector.

Trade Expansion.

Although the over-sea fruit export trade during the past decade has, on the whole, expanded more rapidly than the export trade in other classes of products, it is particularly in connexion with the export of fruit to Germany that the development may be considered as phenomenal. The trade to that country began as recently as 1904, in which year a total of 5.250 cases were exported. The following figures will show how rapid the expansion has been and how great has been the development in comparison with the export to other countries:—

Country.	Year.	Quantity.	Proportional Increase.	Proportional Decrease.
		Cases.		
United Kingdom ..	1904	61,287	3·04	
	1913	186,449		
Germany	1904	5,250	32·28	
	1913	169,505		
South Africa ..	1904	15,250	..	·19
	1913	12,519		
East	1904	6,099	1·22	
	1913	7,339		

The above figures show that the development of the trade with Germany has been nearly thirteen times greater than the combined total expansion with other countries. This would seem to show that, at any rate, under the present methods of marketing the limit of expansion has been more nearly reached in the other countries under notice than is the case with Germany. This is emphasized by the fact that, notwithstanding the rapid growth of the trade to Germany, higher prices are still being obtained for our fruits on the Hamburg and Bremen markets than are realized on the markets of London and Liverpool. There is good reason for believing that no decrease in the demand for our fruits in Germany is likely to take place in the near future, but that with wider and more complete methods of distribution than are at present in vogue the trade with Germany may be indefinitely expanded. At present Hamburg is the chief distributing centre, but

some of our leading exporters to Germany consider that the port of Bremen would, if utilized to the extent which its central position justifies, prove equally as efficient from a distributing point of view as the port of Hamburg, as Bremen possesses direct communication with the large cities of Berlin, Essen, Dusseldorf, Cologne, Frankfort, Mannheim, Hanover, Magdeburg, Leipsic and Dresden.

Wider Distribution in Germany Needed.

As showing the advantages to be derived from shipping direct to centres other than a single distributing centre, it may be pointed out that advices have been received, as this article goes to press, from a leading firm in Hull, stating that the first direct shipment of Tasmanian apples to that port realized the following prices:—

Cleopatras, 12s. 6d. to 13s.
Scarlet Pearmain, 11s. to 11s. 3d.
Jonathans, 14s. to 15s.
Sturmers, 10s. 6d. to 11s. 6d.
French Crab, 10s. 6d. to 12s.
Adam's Pearmain, 11s.
Other varieties, from 10s. 6d. upwards.

The advice further states that "the demand was very keen, and every box was sold. By these prices you will see that we can handle apples equally as well as the best ports in the United Kingdom, and as Hull charges are lower than London, we think shippers would often do more profitable business to ship their goods to Hull. We think this sale constitutes a record in the aggregate for any cargo of Australian apples, and clearly proves that we are able to handle the goods to advantage."

The shipment referred to comprised 12,500 cases.

The same arguments which apply to the opening of new centres in the United Kingdom for the sale of our fruits apply also to Germany, as the realization of good prices is more likely if our fruits are sold from several centres, each competing with the other, than if sold at a single centre for subsequent distribution.

The matter of establishing cool storage depôts at such centres as Hamburg and Bremen similar to the proposed erection of a depôt in London is a matter that may be worthy of attention.

Hamburg and Covent Garden Methods Compared.

One of the chief reasons for the enhanced prices obtained in Germany over those which our fruits command in the United Kingdom is no doubt due to superior methods of displaying consignments in the inspection rooms at German ports prior to auction. Under the arrangements carried out in Covent Garden, buyers do not possess the same facilities for judging the merits of consignments as is the case in Germany. In Covent Garden, a consignment is often sold on the appearance of a single case. In Germany, the consignments are completely exposed for the inspection of intending buyers the day before auction. This enables the buyers to exercise their judgment and mark

HAMBURG APPLE MARKET.

their catalogues in accordance with their observations. The system is *shown in the accompanying illustration of the interior of an inspection* shed at Hamburg. When the fruit is auctioned later, the buyer under this system knows exactly the price he considers he should offer for each consignment. This matter has been mentioned before in previous numbers of the Journal, but it is considered of sufficient importance to justify a repetition.

In addition to the markets of the United Kingdom and Germany, it must not be forgotten that the question of opening a trade with other *European countries than these should be seriously considered.*

Possibilities of Trade with America.

Speaking generally, the European Continent may be considered up to the present, as practically untouched by our fruit exporters. In addition to the United Kingdom and Europe, good markets exist on the North and South American continent for our fruits. The chief difficulty in the matter of opening these up lies in our present inadequate shipping facilities. The Argentine Republic has proved, during the past two years, an exceptionally good market for Tasmanian fruits. Hobart possesses the advantage of a direct steam-ship service with the port of Buenos Aires, and all available space is booked by the Tasmanian growers. Even were this not so, however, shipments to Buenos Aires from Melbourne would, under present conditions, require transhipment at Hobart, and transhipments in connexion with transportation of fruit over long distnces is objectionable from many points of view. On the North American Continent, profitable markets exist at Vancouver, San Francisco, and the cities along the Atlantic seaboard, but, in the absence of direct steam-ship service, the same difficulty exists in reaching these as is the case with shipments to Buenos Aires. There seems little doubt, however, that before long a direct service to San Francisco and Vancouver will become established. The opening of the Panama Canal also should bring the cities of the United States within measurable distance of Victorian shippers. The recent decision by Congress to lower the Tariff on raw products imported into the United States should, when in operation, be a potent factor in assisting to open up a profitable trade between the Commonwealth of Australia and that country. If we desire to establish a trade with the North American Continent it will be essential that our fruits be put up under methods which have been in vogue in Canada and the United States for some years past. These methods provide for the packing of apples and pears under what is called the diagonal-numerical system. This has become so firmly established on the North American Continent that fruit put up under any other method does not command a ready sale The system will be fully explained in the following and subsequent articles.

(*To be continued.*)

TOMATO CULTURE IN VICTORIA.

(*Continued from page 440.*)

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

Irrigation and Cultivation.

The tomato is not a deep-rooting plant, and the leaf surface is large in comparison with its root surface. Evaporation from the leaves is considerable, and this, combined with its shallow feeding qualities, renders it necessary that frequent waterings should be given. Cultivation can be practised in the early stages of field growth with considerable ease, consequently, surface mulching will break up the capillary tubes and arrest evaporation, and hold the moisture in the soil at the height required for the plant. Later on, as the plant enlarges, cultivation cannot be so easily carried on. Evaporation from the untilled surface is increased, and more water is necessary for the requirements of the plant. To reduce this increased evaporation, it will be found a good plan to half fill the furrows with a mulching of straw manure. This arrests evaporation to a large extent, and also places food within reach of the plant. Various implements are used in cultivation. For furrowing and hilling, a reversible mould-board plough is used, or a home-made implement, called a "ditcher," having a mould-board on each side. For cultivation in the furrows after planting, a five-tooth cultivator is generally used, and for the purposes of hand labour the Spanish hoe is the most suitable. The general practice is to irrigate once a week during dry weather, allowing just sufficient water to fill the furrow or furrows. The furrows are then blocked, to hold the water, either singly or in groups, according to fall in the surface; the idea in irrigating tomatoes being to give every plant an equal share of water. In Plate 5, the system of irrigation is grouped into four furrows. The water is held in check in the distributary furrow at + by earth banked across the fall, the water flows along the lateral furrows, as indicated by the arrows, and when all the furrows in the group marked A are filled, watering the ridges 1, 2, 3, 4c. The bank across the distributary furrow is removed to the inlet of the first lateral furrow marked —, this holds all the water in this group, and the stream passes on down the distributary furrow to the next earth check + where it waters the group marked B. This group is then checked by removing the earth from + to — and the water passes on to the next check + and waters the group C. This is checked similarly to A and B, and the water passes on to the next check + and waters the group D, and so on if the sections are longer. The alternate groups E, F, G, are watered on the return. Supposing D to be the last group to be watered on the downward journey, the check + is not removed, but the check + in the first furrow of group E is removed to — across the distributary furrow, and when all the furrows of that group are filled the check + in group F is similarly treated, then group G, and then the water is shut off at the distributary channel, and passed on to the next distributary furrow marked K; this is similarly watered, and so on the whole field is irrigated. This

system can be worked to any number of furrows, according to the fall. If the fall be very slight, a great number of furrows in a group; if fairly steep, every other furrow is watered on the downward passage of the water, and the remaining ones on the backward journey. On very steep slopes the surfaces may be terraced, and the distributary furrows brought along the contour. The Chinese adopt the system described, working on flat surfaces. The main distributary channel is a permanent one in the centre of the path, as described under "Planning Surfaces," and shown in Plates 1 and 5.

Under the system shown in Plate 7, an advantage is gained by using a large volume of water at one time. The distributary furrow is much larger than the lateral furrows. The water is brought along the distributary furrow to the end of the section, and spreads right and left along the lateral furrows, indicated by the arrows. This system is adapted to large areas on almost level surfaces. Should blocking in the distributary furrow be necessary to hold the water to any required level, temporary checks can be placed wherever necessary, by using a piece of canvas attached to a bearer of wood, and placing it across the distributary furrow. The furrows marked A may be used as drainage furrows in the event of heavy continuous rain, or alternately as distributary furrows.

Plate 8 shows the distributary channel brought along the level with the lateral furrows following the fall. Under this system lateral furrows may be watered singly or in groups, according to the volume of water used. If singly, then the earth check + in the distributary channel is turned back to — in furrow No. 1 after that has been filled or thoroughly saturated, this will depend on the fall and length of furrow; then No. 2 is similarly treated, and so on the water is passed along until the end furrow is reached. If watering in groups from a larger channel marked A, then the checks + are placed according to the number of furrows that will carry the volume of water passing through B at one time. These checks can be permanent, each group being served by an independent outlet, as shown. This system may also be worked in the opposite way, bringing the distributary channel down the fall and placing the lateral furrows along the level.

Packing and Marketing.

The tomato plantation should be picked over every day when the fruit begins to ripen. In picking for market the fruit should not be gathered until it shows pink on the blossom end. The fruit should then be taken to the packing shed, and assorted and packed according to its degree of colour: "Ripe," "Medium Ripe," "Green." All culls should be fed to stock or destroyed. Of these three grades, firsts and seconds should be made, making in all six grades—

Ripe	Grade	No.	1
„	„	„	2
Medium ripe	„	„	1
„ „	„	„	2
Green	„	„	1
„	„	„	2

Factory tomatoes need not be graded, but greater care should be exercised with regard to the quality of the fruit supplied.

The case used for transport is the long bushel case, and is generally adopted throughout the State. Separate wrapping of the fruit is not practised, but the cases should be lined with paper on the bottom and sides, and folded over on the fruit on the top after it is packed, and before the lid is nailed on. Packages should all be labelled with the name of the grower and the district, also the grade of fruit contained. In sending tomatoes over long distances special cool trucks should be used, and it is not advisable to send "Ripe" grade under any other method. To many growers these suggestions may seem somewhat extravagant. The present crude and slipshod method of handling tomatoes for market is not conducive to the best interests of the producer, and there should be just as much care taken in placing this fruit on the market as there is in placing peaches or any other dessert variety of fruit.

(To be continued.)

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

Monthly Report Ending 14th July.

The weather of the month under review has been of a somewhat mild nature compared with that of the last month, the morning temperatures on only six occasions falling between 33 and 39 degrees.

Drizzling rain fell for several days in succession, the rainfall for the month being 143 points.

Extremely cold winds blew on occasions, and one day a temperature of only 54 degrees at mid-day was registered.

Although the climatic conditions were severe, egg production has increased by 386 eggs over the same month of the previous competition, the totals being 5,688 eggs last year against 6,074 eggs for the present competition.

The feeding was similar to that of the former month in the morning, but at mid-day a slight proportion of maize meal was given, while at night the ration consisted of wheat 4 parts, cracked maize 3 parts, and occasionally 2 parts stout white oats. In the wet weather more maize than wheat was given. The pens that went into moult have started to lay, as have also the backward ones; still, there is room for improvement in them. The leaders of last month (Pen 6, Spotswood) have fallen back into third place (one hen being in moult), the second pen (No. 23, Gill) is now in the lead with a grand total of 381 eggs. Pen 65, Lawson, has moved up into second place.

The general health of the birds is excellent, all being bright headed, alert, and eager for their food. All traces of the mild form of chicken-pox have disappeared.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913–14.

Commencing 15th April, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during Competition.			Position in Competition.
			April 15 to June 14.	June 15 to July 14.	Total to date—3 months.	
23	White Leghorns ..	J. H. Gill	242	139	381	1
65	,, ..	E. A. Lawson ..	237	124	361	2
6	,, ..	J. S. Spotswood ..	257	101	358	3
61	,, ..	Jno. Campbell ..	228	122	350	4
48	,, ..	Thirkell and Smith ..	212	130	342	5
8	,, ..	E. H. Bridge ..	217	117	334	6
11	,, ..	C. J. Beatty ..	209	124	333	7
46	Black Orpingtons ..	T. W. Coto.. ..	210	115	325	8
21	White Leghorns ..	A. Ross	213	109	322	9
68	,, ..	Jones and Curtis ..	197	116	313	10
31	,, ..	W. G. Swift ..	203	106	309	11
16	Black Orpingtons ..	D. Fisher	189	117	306	12
50	White Leghorns ..	A. H. Mould ..	200	103	303	13
10	,, ..	T. A. Pettigrove ..	177	125	302	14
34	,, ..	J. E. Bradley ..	181	120	301	15
35	,, ..	Moritz Bros. ..	181	109	290	16
66	,, ..	W. Featherstone ..	191	92	283	17
7	,, ..	H. McKenzie ..	160	115	275	18
37	,, ..	C. H. Busst ..	174	100	274	19
40	,, ..	Geo. Edwards ..	175	97	272	20
49	,, ..	M. H. Noye ..	174	97	271	21
47	,, ..	W. McLister .	179	90	269	22
2	,, ..	R. W. Pope .	183	78	261	23
14	,, ..	F. Hannaford ..	173	85	258	24
43	,, ..	Morgan and Watson..	135	119	254	25
32	,, ..	H. Hanbury ..	168	84	252	26
63	,, ..	A. Sellers	162	86	248	27
39	,, ..	W. Purvis	144	104	248	
20	,, ..	C. B. Bertelsmeier .	144	102	246	29
41	,, ..	Percy Walker ..	154	91	245	30
26	,, ..	B. Rolls	139	105	244	31
38	,, ..	M. A. Monk ..	152	89	241	32
25	Black Orpingtons ..	King and Watson ..	133	107	240	33
67	White Leghorns ..	C. Hepburn .	122	115	237	34
58	,, ..	Stranks Bros. ..	137	98	235	35
45	,, .	D. Goudie .	161	74	235	
13	Black Orpingtons ..	T. S. Dallimore ..	116	117	233	37
24	White Leghorns ..	Redfern Poultry Farm	132	98	230	38
18	,, ..	B. Rowlinson ..	148	79	227	39
27	,, ..	J. Sinclair	147	78	225	40
5	,, ..	G. W. Robbins ..	103	110	213	41
3	,, ..	S. Buscumb ..	143	69	212	42
59	S.C. White Leghorns	Cowan Bros. ..	136	68	204	43
22	White Leghorns ..	B. Mitchell .	107	94	201	44
55	,, ..	P. H. Killeen ..	97	94	101	45
52	,, ..	W. G. Osborne ..	95	88	183	46
28	,, ..	E. Waldon ..	120	62	182	47
53	Black Orpingtons ..	A. Greenhalgh ..	133	49	182	
62	White Leghorns ..	G. A. Gent ..	123	54	177	49
57	,, ..	Gleadell Bros. ..	91	74	165	50
17	R.C.Brown Leghorns	S. P. Giles	88	76	164	51
12	White Leghorns ..	A. H. Padman ..	78	78	156	52
19	,, ..	W. Dunlop ..	88	66	154	53
44	,, ..	W. A. Rennie ..	89	63	152	54
33	,, ..	South Yan Yean Poultry Farm	54	97	151	55
42	,, ..	A. Stringer ..	58	90	148	56
56	,, ..	Schaefer Bros. ..	55	87	142	57
51	Black Spanish ..	W. H. Steer ..	41	80	121	58
36	White Leghorns ..	A. J. Jones.. ..	51	67	118	59
15	,, ..	J. Shaw	47	62	109	60
54	,, ..	Jas. McAllan ..	26	73	99	61
64	Golden Wyandottes	C. L. Sharman ..	35	62	97	62
30	Black Orpingtons ..	Jas. Ogden ..	42	52	94	63
29	White Leghorns ..	S. Brundrett ..	30	59	89	64
9	,, ..	Sylvania Stud Farm..	34	44	78	65
60	Black Spanish ..	Watson and Rushworth	12	47	59	66
4	White Leghorns ..	Jas. Brigden ..	25	32	57	67
		Total	9,057	6,074	15,131	

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

The work of pruning should be completed before the end of August. This is particularly necessary this year, as every indication points to an early spring. The winter in June and July has been a very mild one; and in several districts, even at the middle of July, it was observed that the buds of various fruit trees were showing signs of sap movement, and were swelling and changing colour.

For this reason, if the winter spraying has not been carried out, it should be done without delay. One of the most general winter sprays is red oil. The caustic properties of this oil are well known; and in order that no damage will arise from burnt buds, it is advisable to finish the red oil spraying immediately. Once the buds commence to move, all oil preparations should be kept from the trees. It has previously been stated that a strength of 1 in 30 of red oil is amply sufficient to destroy such pests as bryobia mite, scale insects, and woolly aphis; when the oil is used late in the season, it certainly should not be sprayed at a greater strength than this. Red oil may be emulsified by combining it with soft soap, using 1 lb. of soft soap to 1 gallon of oil; or it may be used in combination with lime, using 1½ lbs. of lime, dissolved in water, to 1 gallon of oil, afterwards reducing this down with 30 gallons of water. Many of the red oils now sold are in a prepared form, the oil merely requiring the addition of a small proportion of washing soda to the water before mixing. Crude petroleum or kerosene may also be used in an emulsified form for a winter spray, but general practice has shown that the red oil is the superior of all oil emulsions.

A watch will need to be kept for peach aphis, which makes its advent in the spring. This insect multiplies so rapidly, once it does appear, that, on the first indication of its presence, the trees should be sprayed with a strong tobacco solution. They should be examined on the day after spraying, and if any aphides are still alive, another spraying should be given.

A vigilant watch, and constant sprayings in the early season, will check this pest and will be the means of saving much time next month when it will be urgently needed for other works. Peach, almond, and Japanese plum trees are attacked by the peach aphis. This is also the season when the bryobia mite (red spider) is hatching and breeding. If the trees have received an oil emulsion in the winter, no danger may be feared from this mite. But if not, then an effort must be made to keep it in check by spraying the trees with strong nicotine solution or with one of the proprietary mixtures now on the market. The foliage and young buds are greatly damaged by the attacks of this mite, and so to allow full leaf action, it should be attacked before the flowers or foliage come.

The work of planting will also require to be finished before the end of the month. Indeed, it is not advisable to defer planting even so late. It has often been advanced by growers that late-planted

peaches thrive far better than early-planted ones; but it is well to get the trees in as early as possible, in the event of the season setting in early.

Preparation should now be made for planting orange and lemon trees. These may be lifted and planted out as soon as the season sets in warm; but the soil should be thoroughly drained and sweetened before these trees are planted in their permanent positions. No trees require so thoroughly an aerated soil as the citrus family; and, to insure successful growth, the ground should be placed in good heart before planting. Although the planting of this class of fruit trees may be delayed until midsummer, it is advisable to plant them as soon as the soil is warm enough to induce new root growth, so that they may thoroughly establish themselves during the first season.

Vegetable Garden.

The work in this section during the month of August is comparatively light, provided that it has previously been kept up to date. The soil should be mellowing and sweetening, in anticipation of the planting of the main crop in a little while.

Seeds of lettuce, tomato, cabbage, peas, radish, and broad beans may now be sown. Potatoes may be planted out. Where a frame and hot-bed are in use, celery, cucumber, vegetable marrow, tomato, and pumpkin seeds may be planted.

All seedlings ready for planting out, such as cabbage, cauliflower, onion, and lettuce, may now be planted in the beds. Herbs of all descriptions should be sown.

Flower Garden.

Rose pruning should now be completed. At this time the buds are beginning to swell and show some prominence, and no check should be put in the way of their full development. A careful watch should be kept for the appearance of aphis, which should be washed off as soon as it is noticed. It is advisable to have a specific always on hand, ready made up, so as to kill the aphis when noticed. The aphis is a very rapid breeder, and delay of a few days means an enormous increase of this pest. Quite a number of specifics are useful in combating the aphis—soaperine, tobacco emulsion, strong soapsuds, Robinson's pine spray, and pestend solution are among the useful remedies. Whatever is used, a good application should be given, and it should be repeated at frequent intervals, if the aphides remain.

All herbaceous and similar plants may now be planted out in the beds; these include delphinium, cannas, shasta daisy, rudbeckias, salvias, perennial phlox, &c. These plants should be well fed, so as to allow them to make a rapid and vigorous growth.

Weeds will need frequent attention, as they must be kept in check at this time of the year; they should be prevented from seeding in the beds.

The planting out of shrubs may now be continued and completed as early as possible, so as to allow the roots to get a good hold of the soil before the hot weather sets in. Gladioli may be planted for early flowering, and as well, a few divisions or tubers of dahlias.

Perishable and Frozen Produce.

Description of Produce.		Exports from State (oversea). Quarter ended 30.6.13.	Exports from State (oversea). Quarter ended 30.6.12.	Deliveries from the Government Cool Stores. Quarter ended 30.6.13.	Deliveries from the Government Cool Stores. Quarter ended 30.6.12.
Butter	lbs.	2,240,200	625,184	2,828,392	874,664
Milk (dried) ...	cases	1,690	2	...	...
Milk (concd.) .. .	"	22,336	148	119	1,205
Cheese	lbs.	39,000	26,040	56,480	4,800
Ham and Bacon ...	"	8,400	38,520	...	...
Poultry	head	13,605	3,705	176	2,224
Eggs...	dozen	...	...	33,261	25,149
Mutton and Lamb	carcases	168,173	171,469	1,170	11,520
Beef	quarters	6,094	3,397	118	230
Veal	carcases	1,561	777	...	65
Pork...	"	...	287	252½	820
Rabbits and Hares ...	pairs	626,058	183,444	117,876	130,361
Sundries ...	lbs.	...	...	85,215	24,316

8th July, 1913. R. CROWE, *Exports Superintendent.*

Fruit, Plants, Bulbs, Grain, &c.

Imports and Exports Inspected for Quarter ending 30/6/13.

Description of Goods.	Imports. Inter-State.	Imports. Oversea.	Exports. Oversea.
Apples	190	—	104,264
do. (custard) ...	71	—	—
Bananas, bunches...	29,116	73,410	—
do. cases ...	2,412	29,000	—
Barley	33,826	1	—
Beans	146	891	1
Blackberries ...	259	—	—
Bulbs	3	40	136
Cherries	—	—	329
Chillies	—	71	—
Cocoa beans ...	—	2,610	—
Cocoanuts ...	21	756	—
Coffee beans ...	—	2,749	—
Copra	—	3,214	—
Fruit—			
Canned ...	—	—	2,919
Dried ...	—	7,139	16,472
Mixed ...	3	6	—
Grapes	1	—	5
Green Ginger ...	6	594	—
Hay	—	513	—
Hops	—	368	—
Jams, Sauces, &c....	—	—	1,238
Lemons ...	956	76	1,284
Lentils	—	129	—
Limes	16	—	—
Logs	9	2,000	—
Linseed ...	—	1,123	—

Description of Goods.	Imports. Inter-State.	Imports. Oversea.	Expor[ts.] Overs[ea.]
Maize	4,390	133	
Melons	—	—	
Nutmegs .	—	330	
Nuts	294	2,335	
Oat Hulls ...	829	—	
Oats	2,777	492	
Olives	10	—	
Oranges	47,540	809	1
Passion Fruit ...	236	—	
Paw Paws ...	3	—	
Peaches	—	—	
Pears	5	1	6,4
Peas, dried ...	9,788	30	
Pepper	—	428	
Persimmons ...	—	—	
Pineapples .	8,334	—	1
Plants, Trees, &c...	333	171	4
Plums	—	—	
Potatoes ...	48	—	1,4
Quinces	—	—	
Rice	4,782	148,363	
Seed	1,317	14,357	
Spice	—	6 1	
Tomatoes ...	16	—	
Vegetables ...	678	290	
Wheat, Grain, &c...	93	—	
Yams	192	1	
Grand Totals ...	148,700	293,061	135.

Total number of packages inspected for quarter ending 30th June, 1913 = 577,170.

11th July, 1913. E. MEEKING, *Senior Fruit Inspector*

Rainfall in Victoria.—Second Quarter, 1913.

TABLE showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with the corresponding monthly and quarterly averages for each Basin, deduced from all available records to date.

Basin or District.	April.		May.		June.		Quarter.	
	Total.	Average.	Total.	Average.	Total.	Average.	Total.	Average.
	points.	points.	points.	points.	points.	points.	points.	points.
Glenelg and Wannon Rivers	37	217	31	231	96	349	164	847
Fitzroy, Eumerella, and Merri Rivers	108	251	276	318	127	365	511	934
Hopkins River and Mount Emu Creek	132	204	208	253	122	299	462	756
Mount Elephant and Lake Corangamite	79	201	196	240	127	269	402	710
Cape Otway Forest ...	181	324	414	399	193	451	788	1,174
Moorabool and Barwon Rivers	100	209	320	233	168	263	588	705
Werribee and Saltwater Rivers	125	193	280	209	193	242	598	644
Yarra River and Dandenong Creek	217	307	245	311	211	374	673	992
Koo-wee-rup Swamp ...	166	305	411	308	206	377	783	990
South Gippsland	246	.384	439	311	289	418	974	1,113
Latrobe and Thomson Rivers	204	293	446	282	279	377	929	952
Macallister and Avon Rivers	131	163	382	153	393	250	906	566
Mitchell River	98	211	418	227	484	280	1,000	718
Tambo and Nicholson Rivers	86	165	510	190	564	255	1,160	610
Snowy River	149	226	509	270	606	404	1,264	900
Murray River	35	136	301	178	173	268	509	582
Mitta Mitta and Kiewa Rivers	68	204	394	295	164	505	626	1,004
Ovens River	72	221	302	332	233	526	607	1,079
Goulburn River	99	177	312	250	269	351	680	778
Campaspe River	172	158	254	250	226	313	652	721
Loddon River	125	135	205	191	189	249	519	575
Avon and Richardson Rivers	103	117	208	176	76	223	387	516
Avoca River	98	126	220	178	108	226	426	530
Eastern Wimmera	95	139	201	227	57	300	353	666
Western Wimmera	115	159	81	207	27	265	223	631
Mallee District	66	103	167	152	21	186	254	441
The whole State	104	182	266	230	183	303	553	715

N.B.—100 points = 1 inch.

H. A. HUNT,
Commonwealth Meteorologist.

10th July, 1913.

REMINDERS FOR SEPTEMBER.

LIVE STOCK.

HORSES.—Still continue to feed stabled horses well; feed green-stuff if available. Continue rugging to encourage the shedding of the coat; good grooming will also be beneficial. Continue giving hay or straw to grass-fed working horses. Feed old and badly-conditioned horses liberally.

Cattle.—Cows should still be rugged, but coverings should be removed frequently, in order to enable the animal to get rid of the old coat; or, better still, a good curry-combing may be given. Continue hay or straw. Look up treatment for milk fever in *Year-Book of Agriculture*, 1905, and treat cattle accordingly. Give calves a good warm dry shed. Give the milk to young calves at blood heat.

Pigs.—Supply plenty of bedding in warm well-ventilated sties. Keep sties clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. If pigs are lousy dress with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect sties.

Sheep.—In early districts shearing early gives wool free from grass seed and dust, and assists fattening of sale sheep. Lambs unlikely to go for freezing thrive better when shorn. Where insufficient knowledge of grading crossbred wool exists, draft the coarse sheep from the fine into paddocks or into the shed at shearing time and shear and bale separately. Clean all "daggy" sheep before bringing them on to the shearing board. Clear carefully all straw, chaff, &c., from shearing floor and wool bins.

Poultry.—September is one of the best months for hatching. Incubators should be kept going, and broody hens set. Care must be taken to keep down vermin, as they now breed quickly; use sprays in houses and Insectibane or Pestend in nests—nothing stunts chickens quicker than vermin. The food for young chicks should be fine oatmeal, stale bread crumbs or biscuit meal, a little calcined (dry) bone, and a pinch of powdered charcoal. Slightly moisten with new milk. Make the whole friable, and feed frequently ("little and often") just as much as they will readily eat, as an excess of food only sours and disturbs their digestive organs. Do not feed animal food yet. Milk is safer, and answers same purpose. Keep chicken's feet dry—wet grass causes a chill; and once the birds are chilled, trouble may be expected.

CULTIVATION.

Farm.—Plant early potatoes, and work up fallow for the main crop. Keep fallow for summer forage crops well worked up with the disc and harrows. Make early sowings of mangolds, beet, field carrots, and turnips. Push on with the fallowing in the Northern Districts. Prepare land for tobacco seed beds by burning rubbish on the site; afterwards work up to depth of three or four inches.

Orchard.—Commence spring ploughing; plough in leguminous crops for green manure as soon as the plants are in full flower. Finish grafting early in the month. Spray peach and apricot trees with Bordeaux mixture as the blossom buds are opening, as a preventive against "leaf curl" and "shot hole" fungi; watch for peach aphis, and spray when present with tobacco solution.

Flower Garden.—Cultivate and work up the surface to a fine tilth—clear out all weeds. Water newly-planted shrubs, &c., if the weather is dry. Plant out cannas, early dahlias, chrysanthemums, gladioli, and other herbaceous plants.

Vegetable Garden.—Plant out seedlings. Sow seeds for summer use, such as tomatoes, cucumbers, marrows, pumpkins, melons, &c. Plant out tomatoes, and shelter till frosts are over. Hoe and work up the soil surface.

Vineyard.—Plantation of young vines (grafted or ungrafted) should be concluded before the commencement of September; pruning of old vines likewise, as well as tying down of rods on long-pruned vines. Prune recently-planted vines just before buds commence to swell (if not pruned when planted), cutting strongest cane back to two buds. Do not delay this work until buds have shot, as this seriously weakens the young vine. Towards middle of month, field grafting may be commenced, if weather be fine and warm. If cold and wet, postpone until October. Swab with acid iron sulphate vines which showed signs of Black Spot last season. To avoid burning, this must be completed before the buds commence to swell. Cultivation (scarifying or discing) must receive attention when soil is in suitable condition.

Cellar.—Conclude spring racking early in month, if not already done. Fill up, regularly, all unfortified wines.